Dell™ PowerEdge™ R905

Hardware Owner's Manual

Notes, Notices, and Cautions

NOTE: A NOTE indicates important information that helps you make better use of your computer.

NOTICE: A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

⚠ **CAUTION: A CAUTION indicates a potential for property damage, personal injury, or death.**

Contents

1

About Your System

This section describes the physical, firmware, and software interface features that provide and ensure the essential functioning of your system. The physical connectors on your system's front and back panels provide convenient connectivity and system expansion capability. The system firmware, applications, and operating systems monitor the system and component status and alert you when a problem arises. System conditions can be reported by any of the following:

- Front or back panel indicators
- LCD status messages
- System messages
- Warning messages
- Diagnostics messages
- Alert messages

This section describes each type of message, lists the possible causes, and provides steps to resolve any problems indicated by a message. The system indicators and features are illustrated in this section.

Other Information You May Need

⚠ **CAUTION: The *Product Information Guide* provides important safety and regulatory information. Warranty information may be included within this document or as a separate document.**

- The *Rack Installation Guide* or *Rack Installation Instructions* included with your rack solution describes how to install your system into a rack.
- The *Getting Started Guide* provides an overview of system features, setting up your system, and technical specifications.
- CDs included with your system provide documentation and tools for configuring and managing your system.
- Systems management software documentation describes the features, requirements, installation, and basic operation of the software.

- Operating system documentation describes how to install (if necessary), configure, and use the operating system software.
- Documentation for any components you purchased separately provides information to configure and install these options.
- Updates are sometimes included with the system to describe changes to the system, software, and/or documentation.

  ✎ **NOTE:** Always check for updates on support.dell.com and read the updates first because they often supersede information in other documents.

- Release notes or readme files may be included to provide last-minute updates to the system or documentation or advanced technical reference material intended for experienced users or technicians.

Accessing System Features During Startup

Table 1-1 describes keystrokes that may be entered during startup to access system features. If your operating system begins to load before you enter the keystroke, allow the system to finish booting, and then restart your system and try again.

Table 1-1. Keystrokes for Accessing System Features

Keystroke	Description
<F2>	Enters the System Setup program. See "Using the System Setup Program" on page 43.
<F10>	Enters the Utility Partition main menu to access the System Diagnostics program. See "Running the System Diagnostics" on page 168.
<F11>	Enters the boot mode selection screen, allowing you to choose a boot device.
<F12>	Enters PXE boot.
<Ctrl+E>	Enters the Baseboard Management Controller (BMC) Management Utility, which allows access to the system event log (SEL) and configuration of the remote access controller (RAC) card. See the *BMC User's Guide* for more information on setup and use of BMC.
<Ctrl+R>	Enters the PERC boot utility. See your PERC adapter *User's Guide* for more information.

Table 1-1.   Keystrokes for Accessing System Features *(continued)*

Keystroke	Description
<Ctrl+C>	If a SAS controller is installed, this keystroke enters the SAS Configuration Utility. See your SAS adapter *User's Guide* for more information.
<Ctrl+S>	Option is displayed if you have PXE support enabled through the System Setup Program (see "Integrated Devices Screen" on page 49), or iSCSI boot enabled. This keystroke allows you to configure NIC settings for PXE boot. For more information, see the documentation for the integrated NIC.

Front-Panel Features and Indicators

Figure 1-1 shows the controls, indicators, and connectors located behind the optional rack bezel on the system's front panel.

Figure 1-1.   Front-Panel Features and Indicators
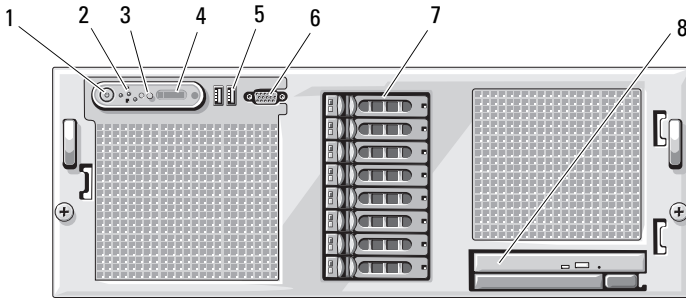
Table 1-2.   Front-Panel Features and Connectors

Item	Component	Icon	Description
1	Power-on indicator, power button	⏻	The power button controls the DC power supply output to the system.
			NOTE: If you turn off the system using the power button and the system is running an ACPI-compliant operating system, the system performs a graceful shutdown before the power is turned off. If the system is not running an ACPI-compliant operating system, the power is turned off immediately after the power button is pressed.
2	NMI button	⊙	Used to troubleshoot software and device driver errors when using certain operating systems. This button can be pressed using the end of a paper clip.
			Use this button only if directed to do so by qualified support personnel or by the operating system's documentation.
3	System identification button	ⓘ	The identification buttons on the front and back panels can be used to locate a particular system within a rack. When one of these buttons is pushed, the blue system status indicator on the front and back blinks until one of the buttons is pushed again.

Table 1-2.   Front-Panel Features and Connectors *(continued)*

Item	Component	Icon	Description
4	LCD display		Provides system ID, status information, and system error messages.
			The LCD display lights during normal system operation. Both the systems management software and the identification buttons located on the front and back of the system can cause the LCD to flash blue to identify a particular system.
			The LCD display lights amber when the system needs attention due to a problem with power supplies, fans, system temperature, or hard drives.
			NOTE: If the system is connected to AC power and an error has been detected, the LCD display lights amber regardless of whether the system has been powered on.
5	USB connectors (2)	⊷⇔	Connects USB 2.0-compliant devices to the system.
6	Video connector	▐▢▌	Connects a monitor to the system.
7	Hard drives (optional)		Five 3.5" drives or eight 2.5" drives.
8	Optical drive (optional)		Optional slimline optical drive **NOTE:** DVD devices are data only.

Hard-Drive Indicator Codes

The hard-drive carriers have two indicators—a drive-activity indicator and a drive-status indicator. See Figure 1-2.

Figure 1-2. Hard-Drive Indicators
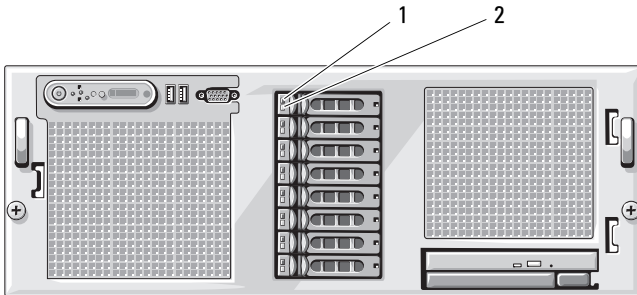
1	drive-status indicator (green and amber) – requires hardware RAID controller	2	green drive-activity indicator

Table 1-3 lists the drive indicator patterns for hard drives connected to a RAID-enabled controller card such as a PERC6i card. Different patterns are displayed as drive events occur in the system. For example, if a hard drive fails, the "drive failed" pattern appears. After the drive is selected for removal, the "drive being prepared for removal" pattern appears, followed by the "drive ready for insertion or removal" pattern. After the replacement drive is installed, the "drive being prepared for operation" pattern appears, followed by the "drive online" pattern.

Table 1-3. Hard-Drive Indicator Patterns for Drives Connected to a RAID Controller Card

Condition	Drive-Status Indicator Pattern
Identify drive/preparing for removal	Blinks green two times per second
Drive ready for insertion or removal	Off **NOTE:** The drive status indicator remains off until all hard drives are initialized after system power is applied. Drives are not ready for insertion or removal during this time.
Drive predicted failure	Blinks green, amber, and off.
Drive failed	Blinks amber four times per second.
Drive rebuilding	Blinks green slowly.
Drive online	Steady green.
Rebuild halted	Blinks green three seconds, amber three seconds, and off six seconds.

Back-Panel Features and Indicators

Figure 1-3 shows the controls, indicators, and connectors located on the system's back panel.

Figure 1-3. Back-Panel Features and Indicators
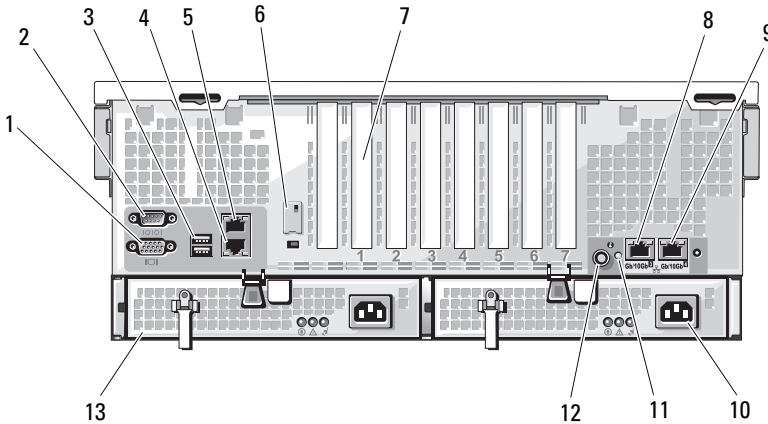
1	video connector	2	serial connector
3	USB connectors (2)	4	integrated NIC connector NIC2
5	integrated NIC connector NIC1	6	remote access controller (optional)
7	expansion-card slots (7)	8	integrated NIC connector NIC3
9	integrated NIC connector NIC4	10	power supply 2
11	system status indicator	12	system identification button
13	power supply 1		

Connecting External Devices

When connecting external devices to your system, follow these guidelines:

- Most devices must be connected to a specific connector and device drivers must be installed before the device operates properly. (Device drivers are normally included with your operating system software or with the device itself.) See the documentation that accompanied the device for specific installation and configuration instructions.

- Always attach external devices while your system is turned off. Next, turn on any external devices before turning on the system (unless the documentation for the device specifies otherwise).

For information about individual connectors, see "Jumpers and Connectors" on page 171. For information about enabling, disabling, and configuring I/O ports and connectors, see "Using the System Setup Program" on page 43.

Power Indicator Codes

The power button on the front panel controls the power input to the system's power supplies. The power indicator can provide information on power status (see Figure 1-1). Table 1-4 lists the power button indicator codes.

Table 1-4. Power Button Indicators

Indicator	Function
On	Indicates that power is supplied to the system and the system is operational.
Flickering	Power is supplied to the system but the system is powering up, or shutting down.
Off	Indicates that no power is supplied to the system.

The indicators on the power supplies show whether power is present or whether a power fault has occurred (see Figure 1-4 and Table 1-5).

Table 1-5. Power Supply Indicators

Indicator	Function
Power supply status	Green indicates that the power supply is operational and providing DC power to the system.
Power supply fault	Amber indicates a problem with the power supply.
AC line status	Green indicates that a valid AC source is connected to the power supply and is operational.

Figure 1-4.   Power Supply Indicators
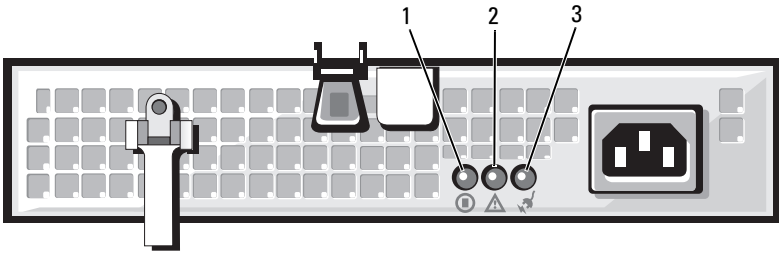
1	power supply status (DC out is operational)	2	power supply fault
3	AC line status (AC in is operational)		

NIC Indicator Codes

Each NIC on the system back panel has an indicator that provides information on network activity and link status. See Figure 1-5. Table 1-6 lists the NIC indicator codes.

Figure 1-5.   NIC Indicators
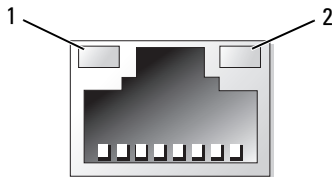
1	link indicator	2	activity indicator

Table 1-6.   NIC Indicator Codes

Indicator	Indicator Code
Link and activity indicators are off	The NIC is not connected to the network.
Link indicator is green	The NIC is connected to a valid link partner on the network.
Activity indicator is blinking amber	Network data is being sent or received.

LCD Status Messages

The system's control panel LCD provides status messages to signify when the system is operating correctly or when the system needs attention.

The LCD lights blue to indicate a normal operating condition, and lights amber to indicate an error condition. The LCD scrolls a message that includes a status code followed by descriptive text. Table 1-7 lists the LCD status messages that can occur and the probable cause for each message. The LCD messages refer to events recorded in the System Event Log (SEL). For information on the SEL and configuring system management settings, see the systems management software documentation.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

▨ **NOTE:** If your system fails to boot, press the System ID button for at least five seconds until an error code appears on the LCD. Record the code, then see "Getting Help" on page 179.

Table 1-7. LCD Status Messages

Line 1 Message	Line 2 Message	Causes	Corrective Actions
N/A	*SYSTEM NAME*	A 62-character string that can be defined by the user in the System Setup program. The *SYSTEM NAME* displays under the following conditions: • The system is powered on. • The power is off and active POST errors are displayed.	This message is for information only. You can change the system string in the System Setup program. See "Using the System Setup Program" on page 43.
E1000	FAILSAFE, Call Support		See "Getting Help" on page 179.
E1114	Temp Ambient	Ambient system temperature is out of acceptable range.	See "Troubleshooting System Cooling Problems" on page 155.
E1210	CMOS Batt	CMOS battery is missing, or the voltage is out of acceptable range.	See "Troubleshooting the System Battery" on page 153.
E1211	ROMB Batt	RAID battery is either missing, bad, or unable to recharge due to thermal issues.	Reseat the RAID battery. See "Installing the SAS RAID Controller Card Battery" on page 113, and "Troubleshooting System Cooling Problems" on page 155.
E12*nn*	# PwrGd	Specified voltage regulator has failed.	See "Getting Help" on page 179.
E1229	CPU # VCORE	Processor # VCORE voltage regulator has failed.	See "Getting Help" on page 179.

Table 1-7.   LCD Status Messages (continued)

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E122A	CPU # VTT	Processor # VTT voltage has exceeded the allowable voltage range	See "Getting Help" on page 179.
E122D	CPU # VDDIO	Processor # VDDIO voltage has exceeded the allowable voltage range	See "Getting Help" on page 179.
E122E	CPU # VDDA	Processor # VDDA voltage has exceeded the allowable voltage range	See "Getting Help" on page 179.
E122F	2.5V PwrGd	2.5V voltage regulator has failed.	See "Getting Help" on page 179.
E1231	1.2V HTCORE PwrGd	1.2V HTCORE voltage regulator has failed.	See "Getting Help" on page 179.
E1232	VDD 12V PS# PwrGd	The specified power supply has failed or has been removed from the bay while the system was on.	If removed, reinsert the power supply into the bay and reconnect to power. For component failures, see "Getting Help" on page 179.
E123B	LOM Mezz PwrGd	Voltage regulator for the NIC daughter card has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 179.
E123C	Planar LOM PwrGd	Voltage regulator for the integrated NIC has failed.	Recycle power to the system or clear the SEL. If the problem persists, see "Getting Help" on page 179.
E1310	RPM Fan ##	RPM of specified cooling fan is out of acceptable operating range.	See "Troubleshooting System Cooling Problems" on page 155.

Table 1-7.   LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E1313	Fan Redundancy	One or more cooling fans has failed. Cooling fan redundancy has been lost.	See "Troubleshooting System Cooling Problems" on page 155.
E1414	CPU # Thermtrip	Specified microprocessor is out of acceptable temperature range and has halted operation.	See "Troubleshooting System Cooling Problems" on page 155. If the problem persists, ensure that the microprocessor heat sinks are properly installed. See "Troubleshooting the Microprocessors" on page 165. **NOTE:** The LCD continues to display this message until the system's power cord is disconnected and reconnected to the AC power source, or the SEL is cleared using either Server Assistant or the BMC Management Utility. See the *Dell OpenManage Baseboard Management Controller User's Guide* for information about these utilities.
E1418	CPU # Presence	Specified processor is missing or bad, or the system is in an unsupported configuration.	See "Troubleshooting the Microprocessors" on page 165.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E141C	CPU Mismatch	Processors are in an unsupported configuration.	Ensure that your processors match and conform to the type described in the Microprocessor Technical Specifications outlined in your system's *Getting Started Guide*.
E141F	CPU Protocol	The system BIOS has reported a processor protocol error.	See "Getting Help" on page 179.
E1420	CPU Bus PERR	The system BIOS has reported a processor bus parity error.	See "Getting Help" on page 179.
E1421	CPU Init	The system BIOS has reported a processor initialization error.	See "Getting Help" on page 179.
E1422	CPU Machine Chk	The system BIOS has reported a machine check error.	See "Getting Help" on page 179.
E1610	PS # Missing	Specified power supply is improperly installed or removed.	See "Troubleshooting Power Supplies" on page 154.
E1614	PS # Status	Specified power supply is improperly installed or faulty.	See "Troubleshooting Power Supplies" on page 154.
E1618	PS # Predictive	Power supply voltage is out of acceptable range; specified power supply is improperly installed or faulty.	See "Troubleshooting Power Supplies" on page 154.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E161C	PS # Input Lost	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If problem persists, see "Troubleshooting Power Supplies" on page 154.
E1620	PS # Input Range	Power source for specified power supply is unavailable, or out of acceptable range.	Check the AC power source for the specified power supply. If problem persists, see "Troubleshooting Power Supplies" on page 154.
E1624	PS Redundancy	Power supply redundancy has been lost. If the remaining power supply fails the system will shut down.	See "Troubleshooting Power Supplies" on page 154.
E1625	PS AC Current	Power source is out of acceptable range.	Check the AC power source.
E1710	I/O Channel Chk	The system BIOS has reported an I/O channel check error.	See "Getting Help" on page 179.
E1711	PCI PERR B## D## F## PCI PERR Slot #	The system BIOS has reported a PCI parity error on a component that resides in PCI configuration space at bus ##, device ##, function ##. The system BIOS has reported a PCI parity error on a component that resides in PCI slot #.	Remove and reseat the specified PCI expansion card. If the problem persists, see "Troubleshooting Expansion Cards" on page 164. If troubleshooting does not resolve the problem, see "Getting Help" on page 179.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E1712	PCI SERR B## D## F## PCI SERR Slot #	The system BIOS has reported a PCI system error on a component that resides in PCI configuration space at bus ##, device ##, function ##. The system BIOS has reported a PCI system error on a component that resides in slot #.	Remove and reseat the specified PCI expansion card. If the problem persists, see "Troubleshooting Expansion Cards" on page 164. If troubleshooting does not resolve the problem, see "Getting Help" on page 179.
E1714	Unknown Err	The system BIOS has determined that there has been an error in the system, but is unable to determine its origin.	See "Getting Help" on page 179.
E171F	PCIE Fatal Err B## D## F## PCIE Fatal Err Slot #	The system BIOS has reported a PCIe fatal error on a component that resides in PCI configuration space at bus ##, device ##, function ##. The system BIOS has reported a PCIe fatal error on a component that resides in slot #.	Remove and reseat the specified PCI expansion card. If the problem persists, see "Troubleshooting Expansion Cards" on page 164. If troubleshooting does not resolve the problem, see "Getting Help" on page 179.
E1810	HDD ## Fault	Specified hard drive has a fault.	See "Troubleshooting a Hard Drive" on page 159.
E1811	HDD ## Rbld Abrt	Specified hard drive has ended rebuild before completion.	See "Troubleshooting a Hard Drive" on page 159.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E1812	HDD ## Removed	Specified hard drive has been removed from the system.	Information only.
E1914	DRAC5 Conn2 Cbl	DRAC 5 cable is missing or unseated.	Reconnect the cable. See "RAC Card" on page 83.
E1A14	SAS Cable A	SAS cable A is unseated, missing, or bad.	Check the cable connection to the SAS backplane. See "SAS Backplane Board Connectors" on page 176.
E1A15	SAS Cable B	SAS cable B is unseated, missing, or bad.	Check the cable connection to the SAS backplane. See "SAS Backplane Board Connectors" on page 176.
E1A1C	LOM Mezz Missing	NIC daughter card is missing.	Install or reseat the NIC daughter card.
E2010	No Memory	No memory is installed in the system.	Install memory modules. See "System Memory" on page 91.
E2011	Mem Config Err	Memory detected, but is not configurable. Error detected during memory configuration.	Check the memory configuration and reinstall the memory modules if necessary. See "System Memory" on page 91. See "Troubleshooting System Memory" on page 156.
E2012	Unusable Memory	Memory is configured, but not usable. Memory subsystem failure.	See "Troubleshooting System Memory" on page 156.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E2013	Shadow BIOS Fail	The system BIOS failed to copy its flash image into memory.	See "Troubleshooting System Memory" on page 156.
E2014	CMOS Fail	CMOS failure. CMOS RAM not functioning properly.	See "Getting Help" on page 179.
E2015	DMA Controller	DMA controller failure.	See "Getting Help" on page 179.
E2016	Int Controller	Interrupt controller failure.	See "Getting Help" on page 179.
E2017	Timer Fail	Timer refresh failure.	See "Getting Help" on page 179.
E2018	Prog Timer	Programmable interval timer error.	See "Getting Help" on page 179.
E2019	Parity Error	Parity error.	See "Getting Help" on page 179.
E201A	SIO Err	SIO failure.	See "Getting Help" on page 179.
E201B	Kybd Controller	Keyboard controller failure.	See "Getting Help" on page 179.
E201C	SMI Init	System management interrupt (SMI) initialization failure.	See "Getting Help" on page 179.
E201D	Shutdown Test	BIOS shutdown test failure.	See "Getting Help" on page 179.
E201E	POST Mem Test	BIOS POST memory test failure.	See "Troubleshooting System Memory" on page 156. If problem persists, see "Getting Help" on page 179.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E201F	DRAC Config	Remote access controller (RAC) configuration failure.	Check screen for specific error messages. Ensure that the RAC card and cables are properly seated. See "RAC Card" on page 83. If problem persists, see your RAC documentation.
E2020	CPU Config	CPU configuration failure.	Check screen for specific error messages.
E2021	Memory Population	Incorrect memory configuration. Memory population order incorrect.	Check screen for specific error messages. See "Troubleshooting System Memory" on page 156.
E2022	POST Fail	General failure after video.	Check screen for specific error messages.
E2110	MBE DIMM ## & ##	One of the DIMMs in the set implicated by "## & ##" has had a memory multi-bit error (MBE).	See "Troubleshooting System Memory" on page 156.
E2111	SBE Log Disable DIMM ##	The system BIOS has disabled memory single-bit error (SBE) logging, and will not resume logging further SBEs until the system is rebooted. "##" represents the DIMM implicated by the BIOS.	See "Troubleshooting System Memory" on page 156.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
E2112	Mem Spare DIMM ##	The system BIOS has spared the memory because it has determined that the memory had too many errors. "##" represents the DIMM implicated by the BIOS.	See "Troubleshooting System Memory" on page 156.
I1910	Intrusion	System cover has been removed.	Information only.
I1911	>3 ERRs Chk Log	LCD overflow message. A maximum of three error messages can display sequentially on the LCD. The fourth message displays as the standard overflow message.	Check the SEL for details on the events.
I1912	SEL Full	System Event Log is full of events and is unable to log any more events.	Clear the log by deleting event entries.
I1915	Video Off (LCD lights with a blue or amber background.)	The video has been turned off by the RAC remote user.	Information only.
I1916	Video Off in ## (LCD lights with a blue or amber background.)	The video will be turned off in *xx* seconds by the RAC remote user.	Information only.

Table 1-7. LCD Status Messages *(continued)*

Line 1 Message	Line 2 Message	Causes	Corrective Actions
W1228	ROMB Batt < 24hr	Warns predictively that the RAID battery has less than 24 hours of charge left.	Replace the RAID battery. See "Installing the SAS RAID Controller Card Battery" on page 113.

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 181.

Solving Problems Described by LCD Status Messages

The code and text on the LCD can often specify a very precise fault condition that is easily corrected. For example, if the code E0708 PROC_1_Presence appears, you know that a microprocessor is not installed in socket 1.

In contrast, you might be able to determine the problem if multiple related errors occur. For example, if you receive a series of messages indicating multiple voltage faults, you might determine that the problem is a failing power supply.

Removing LCD Status Messages

For faults associated with sensors, such as temperature, voltage, fans, and so on, the LCD message is automatically removed when that sensor returns to a normal state. For example, if temperature for a component goes out of range, the LCD displays the fault; when the temperature returns to the acceptable range, the message is removed from the LCD. For other faults, you must take action to remove the message from the display:

- Clear the SEL — You can perform this task remotely, but you will lose the event history for the system.

- Power cycle — Turn off the system and disconnect it from the electrical outlet; wait approximately ten seconds, reconnect the power cable, and restart the system.

Any of these actions will remove fault messages, and return the status indicators and LCD colors to the normal state. Messages will reappear under the following conditions:

- The sensor returns to a normal state but fails again, resulting in a new SEL entry.
- The system is reset and new error events are detected.
- A failure is recorded from another source that maps to the same display entry.

System Messages

System messages appear on the screen to notify you of a possible problem with the system. Table 1-8 lists the system messages that can occur and the probable cause and corrective action for each message.

NOTE: If you receive a system message that is not listed in Table 1-8, check the documentation for the application that is running when the message appears or the operating system's documentation for an explanation of the message and recommended action.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

Table 1-8.   System Messages

Message	Causes	Corrective Actions
`Alert! Node Interleaving disabled! Memory configuration does not support Node Interleaving.`	The memory configuration does not support node interleaving. The system will run but with reduced functionality.	Ensure that the memory modules are installed in a configuration that supports node interleaving. See "General Memory Module Installation Guidelines" on page 92. If the problem persists, see "Troubleshooting System Memory" on page 156.

Table 1-8. System Messages *(continued)*

Message	Causes	Corrective Actions
`Attempting to update Remote Configuration. Please wait...`	Remote Configuration request has been detected and is being processed.	Wait until the process is complete.
`BIOS Manufacturing mode detected. MANUFACTURING MODE will be cleared before the next boot. System reboot required for normal operation.`	System is in manufacturing mode.	Reboot to take the system out of manufacturing mode.
`BIOS Update Attempt Failed!`	Remote BIOS update attempt failed.	Retry the BIOS update. If the problem persists, see "Getting Help" on page 179.
`Caution! NVRAM_CLR jumper is installed on system board.`	NVRAM_CLR jumper is installed. CMOS has been cleared.	Remove the NVRAM_CLR jumper. See Figure 6-1 for jumper locations.
`CPUs with different cache sizes detected!`	Microprocessors with different cache sizes are installed.	Ensure that all microprocessors have the same cache size and that they are properly installed. See "Processors" on page 98.
`Decreasing available memory`	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 156.

Table 1-8. System Messages *(continued)*

Message	Causes	Corrective Actions

`Error: Incorrect memory configuration`
 	
`CPU n`
	The DIMM group for CPU *n* is incorrectly configured and caused the system to halt.	See "General Memory Module Installation Guidelines" on page 92 for memory configuration information. If the problem persists, see "Troubleshooting System Memory" on page 156.

`!*** Error: Remote Access Controller initialization failure *** RAC virtual USB devices may not be available...`	Remote Access Controller initialization failure	Ensure that the Remote Access Controller is properly installed. See "Installing an Optional RAC Card" on page 83.
`Gate A20 failure`	Faulty keyboard controller; faulty system board.	See "Getting Help" on page 179.
`General failure`	The operating system is unable to carry out the command.	This message is usually followed by specific information. Note the information and take the appropriate action to resolve the problem.

`HyperTransport error caused a system reset:`
 	
`HyperTransport device`
 	
`Please check the system event log for details.`
	A fatal system error occurred and caused the system to reboot.	Check the SEL for information that was logged during the error. See the applicable troubleshooting section in "Troubleshooting Your System" on page 143 for any faulty components specified in the SEL.

Table 1-8. System Messages *(continued)*

Message	Causes	Corrective Actions
`Invalid NVRAM configuration, Resource Re-allocated`	System detected and corrected a resource conflict.	No action is required.
`Invalid PCIe card found in the Internal Storage slot!`	The system halted because an invalid PCIe expansion card is installed in the dedicated storage controller slot.	Remove the PCIe expansion card and install a SAS controller in the dedicated slot.
`Keyboard Controller failure`	Faulty keyboard controller; faulty system board	See "Getting Help" on page 179.
`Manufacturing mode detected`	System is in manufacturing mode.	Reboot to take the system out of manufacturing mode.

`Memory address line failure at address, read value expecting value`
 	
`Memory double word logic failure at address, read value expecting value`
 	
`Memory odd/even logic failure at address, read value expecting value`
 	
`Memory write/read failure at address, read value expecting value`
	Faulty or improperly installed memory modules.	See "Troubleshooting System Memory" on page 156.

Table 1-8. System Messages *(continued)*

Message	Causes	Corrective Actions
`Memory tests terminated by keystroke.`	POST memory test terminated by pressing the spacebar.	Information only.
`No boot device available`	Faulty or missing optical drive subsystem, hard drive, or hard-drive subsystem, or no boot disk in drive A.	Use a bootable diskette, CD, or hard drive. If the problem persists, see "Troubleshooting an Optical Drive" on page 158, and "Troubleshooting a Hard Drive" on page 159. See "Using the System Setup Program" on page 43 for information about setting the order of boot devices.
`No boot sector on hard drive`	Incorrect configuration settings in System Setup program, or no operating system on hard drive.	Check the hard-drive configuration settings in the System Setup program. See "Using the System Setup Program" on page 43. If necessary, install the operating system on your hard drive. See your operating system documentation.
`No timer tick interrupt`	Faulty system board.	See "Getting Help" on page 179.
`Optical drive not found`	Cable is not properly seated, or drive is missing.	See "Troubleshooting an Optical Drive" on page 158.

Table 1-8.   System Messages *(continued)*

Message	Causes	Corrective Actions
`PCIe Degraded Link Width Error: Embedded Bus#`*nn*`/Dev#`*nn*`/Func` *n* `Expected Link Width is` *n* `Actual Link Width is` *n*	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Installing an Expansion Card" on page 78. If the problem persists, see "Getting Help" on page 179.
`PCIe Fatal Error caused a system reset: Slot` *n* `or` `Embedded Bus#`*nn*`/Dev#`*nn*`/Func` *n* `Please check the system event log for details.`	Faulty or improperly installed PCIe card in the specified slot.	Reseat the PCIe card in the specified slot number. See "Installing an Expansion Card" on page 78. If the problem persists, see "Getting Help" on page 179.
`PCI BIOS failed to install`	PCI device BIOS (Option ROM) checksum failure is detected during shadowing. A cable to an expansion card is unseated; an expansion card is faulty or improperly installed.	Reseat the expansion cards and expansion card cables. If the problem persists, see "Troubleshooting Expansion Cards" on page 164.
`Plug & Play Configuration Error`	Error encountered in initializing PCI device; faulty system board.	Install the NVRAM_CLR jumper and reboot the system. See Figure 6-1 for jumper locations. If the problem persists, see "Troubleshooting Expansion Cards" on page 164.

Table 1-8. System Messages *(continued)*

Message	Causes	Corrective Actions

`Read fault`
 	
`Requested sector not found`
	The operating system cannot read from the hard drive, the system could not find a particular sector on the disk, or the requested sector is defective.	Replace the diskette. Ensure that the diskette and hard drive cables are properly connected. See "Troubleshooting an Optical Drive" on page 158, or "Troubleshooting a Hard Drive" on page 159 for the appropriate drive(s) installed in your system.

`Remote Access Controller cable error or incorrect card in the RAC slot.`	RAC cables are not connected, or RAC card is installed in the wrong expansion slot.	Check that the RAC cables are connected, and that the RAC card is installed in the correct expansion slot. See "RAC Card" on page 83.
`Remote Access Controller not installed in the RAC slot.`	RAC card is installed in the wrong expansion slot.	Check that the RAC card is installed in the correct expansion slot. See "RAC Card" on page 83.
`Remote configuration update attempt failed`	System unable to process Remote Configuration request.	Retry Remote Configuration.
`ROM bad checksum = address`	An expansion card is improperly installed or is faulty.	Reseat the expansion cards. Ensure that all appropriate cables are securely connected to the expansion cards. If the problem persists, see "Troubleshooting Expansion Cards" on page 164.

`Sector not found`
 	
`Seek error`
 	
`Seek operation failed`
	Faulty hard drive.	See "Troubleshooting a Hard Drive" on page 159.

Table 1-8. System Messages _(continued)_

Message	Causes	Corrective Actions
Shutdown failure	Shutdown test failure.	See "Troubleshooting System Memory" on page 156.
The amount of system memory has changed	Memory has been added or removed or a memory module may be faulty.	If memory has been added or removed, this message is informative and can be ignored. If memory has not been added or removed, check the SEL to determine if single-bit or multi-bit errors were detected and replace the faulty memory module. See "Troubleshooting System Memory" on page 156.
This system supports only Opteron _n_ series processors.	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination. See "Installing a Processor" on page 101.
Time-of-day clock stopped	Faulty battery or faulty chip.	See "Troubleshooting the System Battery" on page 153.
Time-of-day not set - please run SETUP program	Incorrect Time or Date settings; faulty system battery.	Check the Time and Date settings. See "Using the System Setup Program" on page 43. If the problem persists, replace the system battery. See "System Battery" on page 115.
Timer chip counter 2 failed	Faulty system board.	See "Getting Help" on page 179.
TPM failure	A Trusted Platform Module (TPM) function has failed.	See "Getting Help" on page 179.

Table 1-8.   System Messages *(continued)*

Message	Causes	Corrective Actions

`Unsupported CPU combination`
 	
`Unsupported CPU stepping detected`
	Microprocessor(s) is not supported by the system.	Install a supported microprocessor or microprocessor combination. See "Installing a Processor" on page 101.

`Utility partition not available`	The <F10> key was pressed during POST, but no utility partition exists on the boot hard drive.	Create a utility partition on the boot hard drive. See the CDs that came with your system.

`Warning: Following faulty DIMMs are disabled:`
 	
`CPUn: DIMM n`
`CPUn: DIMM n`
 	
`Total memory size is reduced.`
	Faulty or improperly seated memory module(s) used by CPUn.	See "Troubleshooting System Memory" on page 156.

`Warning! No microcode update loaded for processor n`	Microcode update failed.	Update the BIOS firmware. If the problem persists, see "Getting Help" on page 179.
`Warning: One or more faulty DIMMs found on CPUn`	Faulty or improperly seated memory module(s) used by CPUn.	See "Troubleshooting System Memory" on page 156.
`Warning: The installed memory configuration is not optimal. For more information on valid memory configurations, please see the system documentation on the technical support web site.`	Invalid memory configuration. The system will run but with reduced functionality.	Ensure that the memory modules are installed in a valid configuration. See "General Memory Module Installation Guidelines" on page 92. If the problem persists, see "Troubleshooting System Memory" on page 156.

Table 1-8. System Messages *(continued)*

Message	Causes	Corrective Actions

`Write fault`
 	
`Write fault on selected drive`
	Faulty optical drive, hard drive, or hard-drive subsystem.	See "Troubleshooting an Optical Drive" on page 158 or "Troubleshooting a Hard Drive" on page 159.

NOTE: For the full name of an abbreviation or acronym used in this table, see "Glossary" on page 181.

Warning Messages

A warning message alerts you to a possible problem and prompts you to respond before the system continues a task. For example, before you format a diskette, a message will warn you that you may lose all data on the diskette. Warning messages usually interrupt the task and require you to respond by typing y (yes) or n (no).

NOTE: Warning messages are generated by either the application or the operating system. For more information, see the documentation that accompanied the operating system or application.

Diagnostics Messages

The system diagnostic utilities produce messages from diagnostic tests run on your system. See "Running the System Diagnostics" on page 167 for more information about system diagnostics.

Alert Messages

Systems management software generates alert messages for your system. Alert messages include information, status, warning, and failure messages for drive, temperature, fan, and power conditions. For more information, see the systems management software documentation.

2

Using the System Setup Program

After you set up your system, run the System Setup program to familiarize yourself with your system configuration and optional settings. Record the information for future reference.

You can use the System Setup program to:

- Change the system configuration stored in NVRAM after you add, change, or remove hardware
- Set or change user-selectable options—for example, the time or date
- Enable or disable integrated devices
- Correct discrepancies between the installed hardware and configuration settings

Entering the System Setup Program

1 Turn on or restart your system.

2 Press <F2> immediately after you see the following message:

    F2 = System Setup

If your operating system begins to load before you press <F2>, allow the system to finish booting, and then restart your system and try again.

> **NOTE:** To ensure an orderly system shutdown, see the documentation that accompanied your operating system.

Responding to Error Messages

You can enter the System Setup program by responding to certain error messages. If an error message appears while the system is booting, make a note of the message. Before entering the System Setup program, see "System Messages" on page 33 for an explanation of the message and suggestions for correcting errors.

> **NOTE:** After installing a memory upgrade, it is normal for your system to send a message the first time you start your system.

Using the System Setup Program

Table 2-1 lists the keys that you use to view or change information on the System Setup program screens and to exit the program.

Table 2-1.   System Setup Program Navigation Keys

Keys	Action
<Enter>	From the main menu, selects an option that has a submenu, such as Memory Information.
Up arrow or <Shift><Tab>	Moves to the previous field.
Down arrow or <Tab>	Moves to the next field.
Spacebar, <+>, <−>, left and right arrows	Cycles through the settings in a field. In many fields, you can also type the appropriate value.
<Esc>	From the main menu:
	Exits the System Setup program and restarts the system if any changes (other than time and date) were made and you wish to save them.
	If no changes are made, system boot will resume.
	From a submenu, returns the program to the main menu.
<F1>	Displays the System Setup program's help text.

NOTE: For most of the options, any changes that you make are recorded but do not take effect until you restart the system.

System Setup Options

Main Screen

When you enter the System Setup program, the main System Setup program screen appears (see Figure 2-1).

Figure 2-1. Main System Setup Program Screen

```
         Dell Inc. (www.dell.com) - PowerEdge R905
                   BIOS Version: XX.XX.XX

Service Tag : XXXXXXX                  Asset Tag : XXXXXXXXX

System Time  .........................................08:15:45
System Date  .........................................Sat December 1, 2007

Memory Information  .................................<ENTER>
CPU Information  ....................................<ENTER>

Boot Sequence .........................................<ENTER>
Hard-Disk Drive Sequence ............................<ENTER>
USB Flash Drive Emulation Type ......................<ENTER>
Boot Sequence Retry .................................Disabled

Integrated Devices  .................................<ENTER>
PCI IRQ Assignment  .................................<ENTER>

Serial Communication  ...............................<ENTER>
Embedded Server Management ..........................<ENTER>

System Security  ....................................<ENTER>

Keyboard Numlock  ...................................<ENTER>
Report Keyboard Errors ..............................Report

Up,Down Arrow to select  |  SPACE,+,- to change  |  ESC to exit  |  F1=Help
```

Table 2-2 lists the options and descriptions for the information fields that appear on the main System Setup program screen. For related information, see "System Security Screen Options" on page 51.

NOTE: The options for the System Setup program change based on the system configuration.

NOTE: The System Setup program defaults are listed under their respective options in the following sections, where applicable.

Table 2-2. System Setup Program Options

Option	Description
System Time	Sets the time on the system's internal clock.
System Date	Sets the date on the system's internal calendar.
Memory Information	Displays information related to installed memory. See "Memory Information Screen" on page 47.
CPU Information	Displays information related to microprocessors (speed, cache size, and so on). See "CPU Information Screen" on page 48.

Table 2-2.   System Setup Program Options *(continued)*

Option	Description
Boot Sequence	Determines the order of devices from which the system attempts to boot during system startup. Available options can include a diskette drive, CD drive, hard drives, and network. **NOTE:** System boot is not supported from an external device attached to a SAS adapter. See support.dell.com for the latest support information about booting from external devices.
Hard-Disk Drive Sequence	Determines the order in which the BIOS will attempt to boot from hard drives in the system during system startup.
USB Flash Drive Emulation Type (**Auto** default)	Determines the emulation type for a USB flash drive. **Hard disk** allows the USB flash drive to act as a hard drive. **Floppy** allows the USB flash drive to act as a removable diskette drive. **Auto** automatically chooses the appropriate emulation type for the device, except for devices installed in the SD card slot. A device installed in the SD card slot will automatically emulate a hard drive. If you install a device in this slot that is configured as a removable diskette drive, you must manually set the emulation type to **Floppy**.
Boot Sequence Retry	If this field is enabled and the system has failed to boot, the system will reattempt to boot after 30 seconds.
Integrated Devices	See "Integrated Devices Screen" on page 49.
PCI IRQ Assignment	Displays a screen to change the IRQ assigned to each of the integrated devices on the PCI bus, and any installed expansion card that requires an IRQ.
Serial Communication (**Off** default)	See "Serial Communication Screen" on page 51.
Embedded Server Management	Displays a screen to configure the front-panel LCD options and to set a user-defined LCD string.
System Security	Displays a screen to configure the system password and setup password features. See "System Security Screen" on page 51, "Using the System Password" on page 55, and "Using the Setup Password" on page 57 for more information.

Table 2-2.   System Setup Program Options *(continued)*

Option	Description
Keyboard NumLock (**On** default)	Determines whether your system starts up with the NumLock mode activated on 101- or 102-key keyboards (does not apply to 84-key keyboards).
Report Keyboard Errors (**Report** default)	Enables or disables reporting of keyboard errors during the POST. Select **Report** for host systems that have keyboards attached. Select **Do Not Report** to suppress all error messages relating to the keyboard or keyboard controller during POST. This setting does not affect the operation of the keyboard itself if a keyboard is attached to the system.

Memory Information Screen

Table 2-4 lists the descriptions for the information fields that appear on the **Memory Information** screen.

Table 2-3.   Memory Information Screen

Option	Description
System Memory Size	Displays the amount of system memory.
System Memory Type	Displays the type of system memory.
System Memory Speed	Displays the system memory speed.
Video Memory	Displays the amount of video memory.
System Memory Testing	This option determines whether system memory tests are run at system boot. Options are **Enabled** and **Disabled**.
Redundant Memory (**Disabled** default)	Enables or disables the redundant memory feature. Redundant memory feature is disabled if the Node Interleaving field is enabled.
Node Interleaving (**Disabled** default)	If this field is enabled, memory interleaving is supported if a symmetric memory configuration is installed. If this field is set to **Disabled**, the system can support Non-Uniform Memory architecture (NUMA) (asymmetric) memory configurations. **NOTE:** The Node Interleaving field must be set to Disabled when using the redundant memory feature.

Table 2-3.   Memory Information Screen *(continued)*

Option	Description
Memory Optimizer Technology (**Enabled** default)	Sets the behavior of the two DRAM controllers for memory optimization. When set to **Enabled**, the two controllers run in parallel 64-bit mode for improved memory performance (running single-bit ECC).When set to **Disabled**, the controllers are joined in 128-bit mode running multi-bit Advanced ECC.
Low Power Mode (**Disabled** default)	Enables or disables the low power mode of the memory. When set to **Disabled**, the memory runs at full speed. When set to **Enabled**, the memory runs at a reduced speed to conserve energy.

CPU Information Screen

Table 2-4 lists the options and descriptions for the information fields that appear on the **CPU Information** screen.

Table 2-4.   CPU Information Screen

Option	Description
64-bit	Specifies if the installed processor(s) support 64-bit extensions.
Core Speed	Displays the clock speed of the processor(s).
Bus Speed	Displays the bus speed of the processor(s).
Virtualization Technology (**Enabled** default)	**NOTE:** Disable this feature if your system will not be running virtualization software. Displays when the processors support Virtualization Technology. **Enabled** permits virtualization software to use Virtualization Technology incorporated in the processor design. This feature can only be used by software that supports Virtualization Technology.

Table 2-4.   CPU Information Screen *(continued)*

Option	Description
Demand-Based Power Management (**Disabled** default)	Enables or disables demand-based power management. When enabled, the CPU Performance State tables will be reported to the operating system; when disabled, the CPU Performance State tables will not be reported to the operating system. If any of the CPUs do not support demand-based power management, the field will become read-only and automatically set to **Disabled**.
Processor X ID	Displays the model number of the processor. A submenu displays the amount of level 2 cache and number of cores.

Enabling AMD PowerNow!™ Technology

AMD PowerNow! technology controls your system's processor performance automatically, dynamically adjusting the operating frequency and voltage according to the task at hand. When an application does not require full performance, significant amounts of power can be saved. Performance is designed to still be responsive, with maximum processor performance being delivered when required, and automatic power savings when possible.

NOTE: AMD PowerNow! support is dependent on the operating system and version used on your system. Disable AMD PowerNow! if your operating system does not fully support this feature. See your operating system user guide for more information.

To disable the AMD PowerNow! feature, run the System Setup Program and disable the **Demand-Based Power Management** option on the **CPU Information** screen.

Integrated Devices Screen

Table 2-5 lists the options and descriptions for the information fields that appear on the **Integrated Devices** screen.

Table 2-5.   Integrated Devices Screen Options

Option	Description
Integrated SAS/RAID Controller (**Enabled** default)	Enables or disables the integrated SAS controller.
Optical Drive Controller (**On** default)	Enables or disables the integrated optical drive controller.
User Accessible USB Ports (**All Ports On** default)	Enables or disables the system's user accessible USB ports. Options are **All Ports On**, **Only Back Ports On**, and **All Ports Off**.
Internal USB Port (**On** default)	Enables or disables the system's internal USB port.
SD Card Port	Enables or disables the system's internal SD card port. **NOTE:** This port is dedicated to a hypervisor, if installed.
Embedded Gb NIC*x* (NIC1 default: **Enabled with PXE**; Other NICs: **Enabled**)	Enables or disables the system's integrated NICs. Options are **Enabled**, **Enabled with PXE**, **Enabled with iSCSI Boot**, and **Disabled**. PXE support allows the system to boot from the network. Changes take effect after the system reboots.
MAC Address	Displays the MAC address for the integrated 10/100/1000 NIC. This field does not have user-selectable settings.
Capability Detected	Displays the NIC features provided by the NIC hardware key installed in the TOE_KEY socket on the system board. **NOTE:** Some features may require the installation of an additional driver.

Serial Communication Screen

Table 2-6 lists the options and descriptions for the information fields that appear on the **Serial Communication** screen.

Table 2-6. **Serial Communication Screen Options**

Option	Description
Serial Communication (**On without Console Redirection** default)	Options are **On without Console Redirection**, **On with Console Redirection via COM1**, **On with Console Redirection via COM2**, and **Off**.
External Serial Connector (**COM1** default)	Specifies whether **COM1**, **COM2**, or **Remote Access Device** has access to the external serial connector for serial communications.
Failsafe Baud Rate (**115200** default)	Displays the failsafe baud rate used for console redirection when the baud rate cannot be negotiated automatically with the remote terminal. This rate should not be adjusted.
Remote Terminal Type (**VT 100/VT 220** default)	Select either **VT 100/VT 220** or **ANSI**.
Redirection After Boot (**Enabled** default)	Enables or disables BIOS console redirection after your system boots to the operating system.

System Security Screen

Table 2-7 lists the options and descriptions for the information fields that appear on the **System Security** screen.

Table 2-7. **System Security Screen Options**

Option	Description
System Password	Displays the current status of your system's password security feature and allows you to assign and verify a new system password.
	NOTE: See "Using the System Password" on page 55 for instructions on assigning a system password and using or changing an existing system password.

Table 2-7. System Security Screen Options *(continued)*

Option	Description
Setup Password	Restricts access to the System Setup program in the same way that you restrict access to your system using the system password feature.
	NOTE: See "Using the Setup Password" on page 57 for instructions on assigning a setup password and using or changing an existing setup password.
Password Status	Setting the **Setup Password** option to **Enabled** prevents the system password from being changed or disabled at system start-up.
	To *lock* the system password, assign a setup password in the **Setup Password** option and then change the **Password Status** option to **Locked**. In this state, you cannot change the system password using the **System Password** option and cannot be disabled at system start-up by pressing <Ctrl><Enter>.
	To *unlock* the system password, enter the setup password in the **Setup Password** field and then change the **Password Status** option to **Unlocked**. In this state, you can disable the system password at system start-up by pressing <Ctrl><Enter> and then change the password using the **System Password** option.
TPM Security (**Off** default)	**NOTE:** TPM functionality is not available in China.
	Sets the reporting of the Trusted Platform Module (TPM) in the system.
	When set to **Off**, presence of the TPM is not reported to the operating system.
	When set to **On with Pre-boot Measurements**, the system reports the TPM to the operating system and stores the pre-boot measurements (compliant with Trusted Computing Group standards) to the TPM during POST.
	When set to **On without Pre-boot Measurements**, the system reports the TPM to the operating system and bypasses pre-boot measurements.

Table 2-7.   System Security Screen Options *(continued)*

Option	Description
TPM Activation	Changes the operational state of the TPM.
	When set to **Activate**, the TPM is enabled and activated at default settings.
	When set to **Deactivate**, the TPM is disabled and deactivated.
	The **No Change** state initiates no action. The operational state of the TPM remains unchanged (all user settings for the TPM are preserved).
	NOTE: This field is read-only when **TPM Security** is set to **Off**.
TPM Clear (**No** default)	⊜ **NOTICE:** Clearing the TPM will cause loss of all encryption keys in the TPM. This option will prevent booting to the operating system and will result in loss of data if the encryption keys cannot be restored. Be sure to back up the TPM keys prior to enabling this option.
	When set to **Yes**, all the contents of the TPM are cleared.
	NOTE: This field is read-only when **TPM Security** is set to **Off**.
Power Button (**Enabled** default)	Enables or disables the power off function of the power button. When enabled, the power button powers off the system as follows:
	• If the system is running an ACPI-compliant operating system, the system performs an orderly shutdown before power is turned off.
	• If the system is not running an ACPI-compliant operating system, power is turned off immediately after the power button is pressed.
	When disabled, the button can only turn on system power.
	NOTE: You can still turn on the system by using the power button, even if the **Power Button** option is set to **Disabled**.

Table 2-7. System Security Screen Options *(continued)*

Option	Description
NMI Button	⊘ **NOTICE:** Use the NMI button only if directed to do so by qualified support personnel or by the operating system's documentation. Pressing this button halts the operating system and displays a diagnostic screen.
	Enables or disables the NMI feature.
AC Power Recovery (**Last** default)	Determines how the system reacts when power is restored to the system. If system is set to **Last**, the system returns to the last power state. **On** turns on the system after power is restored. When set to **Off**, the system remains off after power is restored.

Exit Screen

After you press <Esc> to exit the System Setup program, the **Exit** screen displays the following options:

- `Save Changes and Exit`
- `Discard Changes and Exit`
- `Return to Setup`

System and Setup Password Features

⊘ **NOTICE:** The password features provide a basic level of security for the data on your system. If your data requires more security, use additional forms of protection, such as data encryption programs.

⊘ **NOTICE:** Anyone can access the data stored on your system if you leave the system running and unattended without having a system password assigned or if you leave your system unlocked so that someone can disable the password by changing a jumper setting.

Your system is shipped to you without the system password feature enabled. If system security is a concern, operate your system only with system password protection.

To change or delete an existing password, you must know the password (see "Deleting or Changing an Existing System Password" on page 57). If you forget your password, you cannot operate your system or change settings in the System Setup program until a trained service technician changes the

password jumper setting to disable the passwords, and erases the existing passwords. This procedure is described in "Disabling a Forgotten Password" on page 171.

Using the System Password

After a system password is assigned, only those who know the password have full use of the system. When the **System Password** option is set to **Enabled**, the system prompts you for the system password after the system starts.

Assigning a System Password

Before you assign a system password, enter the System Setup program and check the **System Password** option.

When a system password is assigned, the setting shown for the **System Password** option is **Enabled**. If the setting shown for the **Password Status** is **Unlocked**, you can change the system password. If the **Password Status** option is **Locked**, you cannot change the system password. When the system password feature is disabled by a jumper setting, the system password is **Disabled**, and you cannot change or enter a new system password.

When a system password is not assigned and the password jumper on the system board is in the enabled (default) position, the setting shown for the **System Password** option is **Not Enabled** and the **Password Status** field is **Unlocked**. To assign a system password:

1 Verify that the **Password Status** option is set to **Unlocked**.

2 Highlight the **System Password** option and press <Enter>.

3 Type your new system password.

   You can use up to 32 characters in your password.

   As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

   The password assignment is not case-sensitive. However, certain key combinations are not valid. To erase a character when entering your password, press <Backspace> or the left-arrow key.

   NOTE: To escape from the field without assigning a system password, press <Enter> to move to another field, or press <Esc> at any time prior to completing step 5.

4 Press <Enter>.

5 To confirm your password, type it a second time and press <Enter>.

The setting shown for the **System Password** changes to **Enabled**. Exit the System Setup program and begin using your system.

6 Either reboot your system now for your password protection to take effect or continue working.

> ✎ **NOTE:** Password protection does not take effect until you reboot the system.

Using Your System Password to Secure Your System

> ✎ **NOTE:** If you have assigned a setup password (see "Using the Setup Password" on page 57"), the system accepts your setup password as an alternate system password.

When the **Password Status** option is set to **Unlocked**, you have the option to leave the password security enabled or to disable the password security.

To leave the password security enabled:

1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

2 Type your password and press <Enter>.

To disable the password security:

1 Turn on or reboot your system by pressing <Ctrl><Alt><Del>.

2 Type your password and press <Ctrl><Enter>.

When the **Password Status** option is set to **Locked** whenever you turn on your system or reboot your system by pressing <Ctrl><Alt><Del>, type your password and press <Enter> at the prompt.

After you type the correct system password and press <Enter>, your system operates as usual.

If an incorrect system password is entered, the system displays a message and prompts you to re-enter your password. You have three attempts to enter the correct password. After the third unsuccessful attempt, the system displays an error message showing the number of unsuccessful attempts and that the system has halted and will shut down. This message can alert you to an unauthorized person attempting to use your system.

Even after you shut down and restart the system, the error message continues to be displayed until the correct password is entered.

NOTE: You can use the **Password Status** option in conjunction with the **System Password** and **Setup Password** options to further protect your system from unauthorized changes.

Deleting or Changing an Existing System Password

1 When prompted, press <Ctrl><Enter> to disable the existing system password.

If you are asked to enter your setup password, contact your network administrator.

2 Enter the System Setup program by pressing <F2> during POST.

3 Select the **System Security** screen field to verify that the **Password Status** option is set to **Unlocked**.

4 When prompted, type the system password.

5 Confirm that **Not Enabled** is displayed for the **System Password** option.

If **Not Enabled** is displayed for the **System Password** option, the system password has been deleted. If **Enabled** is displayed for the **System Password** option, press the <Alt><b> key combination to restart the system, and then repeat steps 2 through 5.

Using the Setup Password

Read the information in the following sections to assign or change your setup password.

Assigning a Setup Password

You can assign (or change) a setup password only when the **Setup Password** option is set to **Not Enabled**. To assign a setup password, highlight the **Setup Password** option and press the <+> or <−> key. The system prompts you to enter and verify the password. If a character is illegal for password use, the system beeps.

NOTE: The setup password can be the same as the system password. If the two passwords are different, the setup password can be used as an alternate system password. However, the system password cannot be used in place of the setup password.

You can use up to 32 characters in your password.

As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

The password assignment is not case-sensitive. However, certain key combinations are not valid. If you enter one of these combinations, the system beeps. To erase a character when entering your password, press <Backspace> or the left-arrow key.

After you verify the password, the **Setup Password** setting changes to **Enabled**. The next time you enter the System Setup program, the system prompts you for the setup password.

A change to the **Setup Password** option becomes effective immediately (restarting the system is not required).

Operating With a Setup Password Enabled

If **Setup Password** is set to **Enabled**, you must enter the correct setup password before you can modify most of the System Setup options. When you start the System Setup program, the program prompts you to enter a password.

If you do not enter the correct password in three attempts, the system lets you view, but not modify, the System Setup screens—with the following exception: If **System Password** is not set to **Enabled** and is not locked through the **Password Status** option, you can assign a system password.

NOTE: You can use the Password Status option in conjunction with the Setup Password option to protect the system password from unauthorized changes.

Deleting or Changing an Existing Setup Password

1 Enter the System Setup program and select the **System Security** option.

2 Highlight the **Setup Password** option, press <Enter> to access the setup password window, and press <Enter> twice to clear the existing setup password.

   The setting changes to **Not Enabled**.

3 If you want to assign a new setup password, perform the steps in "Assigning a Setup Password" on page 57.

Disabling a Forgotten Password

See "Disabling a Forgotten Password" on page 171.

Baseboard Management Controller Configuration

The Baseboard Management Controller (BMC) enables configuring, monitoring, and recovery of systems remotely. BMC provides the following features:

- Uses the system's integrated NIC
- Enables fault logging and SNMP alerting
- Provides access to system event log and sensor status
- Allows control of system functions including power on and off
- Functions independently of the system's power state or the system's operating system
- Provides text console redirection for system setup, text-based utilities, and operating system consoles

✍ **NOTE:** To remotely access the BMC through the integrated NIC, you must connect the network connection to integrated NIC1.

For additional information on using BMC, see the documentation for the BMC and systems management applications.

Entering the BMC Setup Module

1 Turn on or restart your system.
2 Press <Ctrl-E> when prompted after POST.

   If your operating system begins to load before you press <Crtl-E>, allow the system to finish booting, and then restart your system and try again.

BMC Setup Module Options

For information about the BMC Setup Module options and how to configure the emergency management port (EMP), see the *BMC User's Guide*.

3

Installing System Components

This section describes how to install the following system components:

- Front bezel
- System cover
- Cooling fan modules
- Cooling shroud assembly
- Power supplies
- Processor expansion module (PEM)
- Expansion cards
- Riser board
- RAC card
- Internal USB memory key
- TOE/iSCSI key
- SD memory card
- NIC daughter card
- System memory
- Processors
- Optical drive
- Hard drives
- SAS controller card
- RAID battery
- External SAS tape drive
- External Fibre Channel device
- System battery
- Control panel assembly
- Chassis intrusion switch
- SAS backplane board

- Peripheral interposer board
- Fan interposer board
- System board
- Power distribution board
- Processor expansion module board

Recommended Tools

You may need the following items to perform the procedures in this section:

- Key to the system keylock
- #2 Phillips screwdriver
- T10 Torx driver
- Small flat-blade screwdriver
- Wrist grounding strap

Inside the System

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

In Figure 3-1, the bezel, system cover, processor expansion module, and cooling shroud assembly are removed to provide an interior view of the system.

⊘ **NOTICE:** Do not remove the cooling shroud assembly if the system is turned on. The cooling shroud assembly must be installed to direct the airflow from the fans.

Figure 3-1.   Inside the System
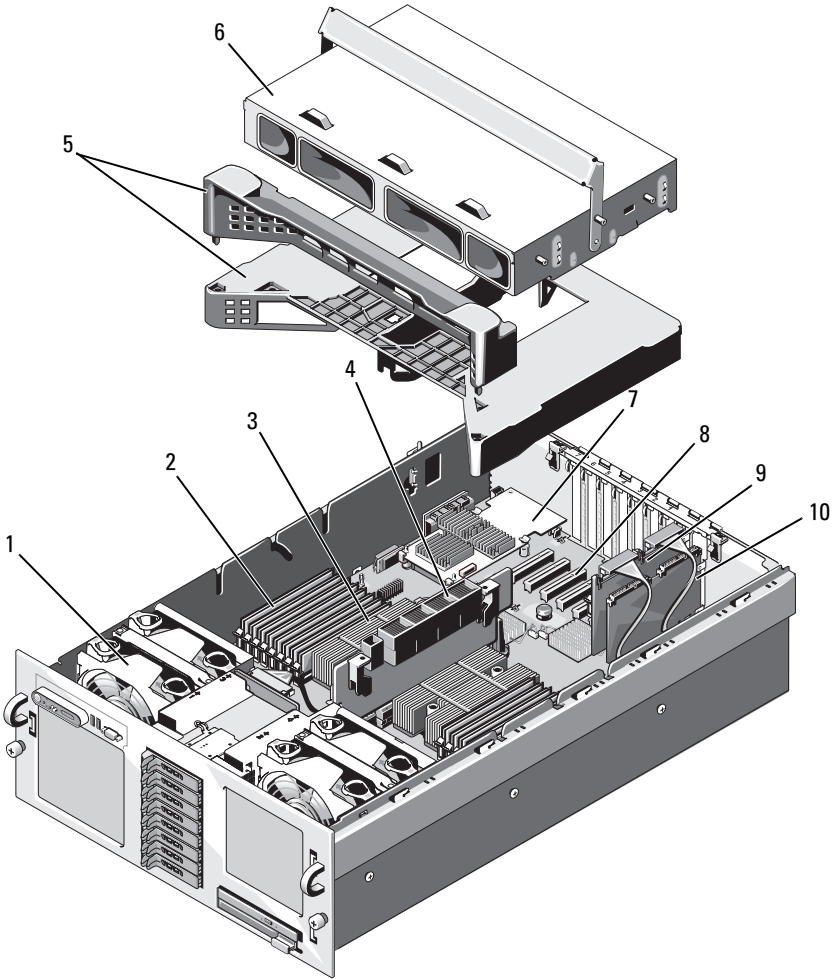
| 1	fan modules (4)	2	memory modules (16)
3	heatsink/processor (2)	4	riser board
5	cooling shroud assembly	6	processor expansion module
7	NIC daughter card	8	expansion card slots (7)
9	SAS controller card	10	optional RAC

The system board holds the system's control circuitry and other electronic components. The processors and memory modules are installed on the system board, and on the optional processor expansion module (PEM).

The hard-drive bays provide space for up to eight optional 2.5-inch hard drives or five optional 3.5-inch SAS hard drives. The hard drives connect to a SAS controller card or an optional battery-cached SAS RAID controller card through a SAS backplane. A removable drive carrier supports an optional optical drive.

Removing and Replacing the Optional Front Bezel

1 Unlock the keylock at the left end of the bezel.
2 Rotate the left end of the bezel away from the front panel.
3 Unhook the right end of the bezel and pull the bezel away from the system.

Figure 3-2. Removing and Replacing the Optional Front Bezel

| 1 | bezel | 2 | key lock |
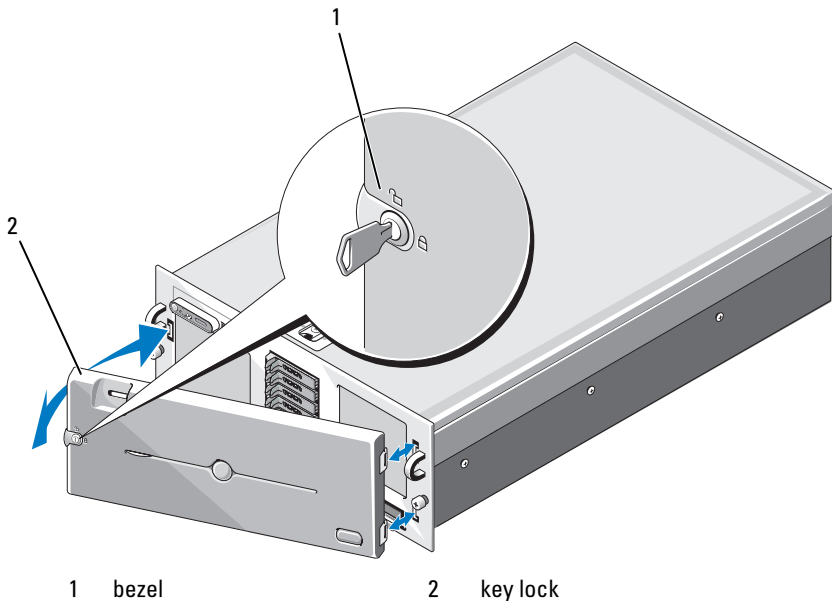
To replace the optional bezel, hook the right end of the bezel onto the chassis, then fit the free end of the bezel onto the system. Secure the bezel with the keylock. See Figure 3-2.

Opening and Closing the System

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

⚠ **CAUTION: Whenever you need to lift the system, get others to assist you. To avoid injury, do not attempt to lift the system by yourself.**

Opening the System

1 Unless you are installing a hot-plug component such as a cooling fan or hard-disk drive, turn off the system and attached peripherals, and disconnect the system from the electrical outlet and peripherals.

2 Rotate the latch release lock on the latch in a counter clockwise direction to the unlocked position. See Figure 3-3.

3 Lift up on the latch on top of the system and slide the cover back. See Figure 3-3.

4 Grasp the cover on both sides and carefully lift the cover away from the system.

Figure 3-3.   Removing and Replacing the System Cover
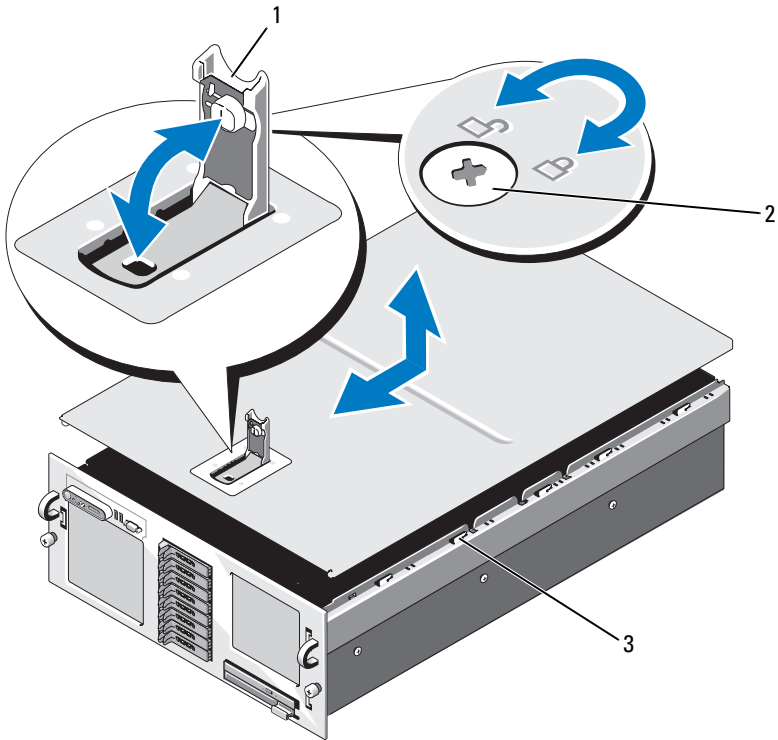
1	latch	2	latch release lock
3	chassis hooks		

Closing the System

1. Lift up the latch on the cover.

2. Align the cover with the left and right edges of the system and offset it slightly towards the back of the system, so that the pins on the inner edge of the cover are aligned with the chassis hooks. See Figure 3-3.

3. Lower the cover onto the chassis and close the latch.

4. Rotate the latch release lock in a clockwise direction to secure the cover.

Cooling Fans

This system contains four hot-plug cooling fans, connected directly to the system board.

NOTICE: In the event of a problem with a particular fan, the fan's number is referenced by the system's management software, allowing you to easily identify and replace the proper fan.
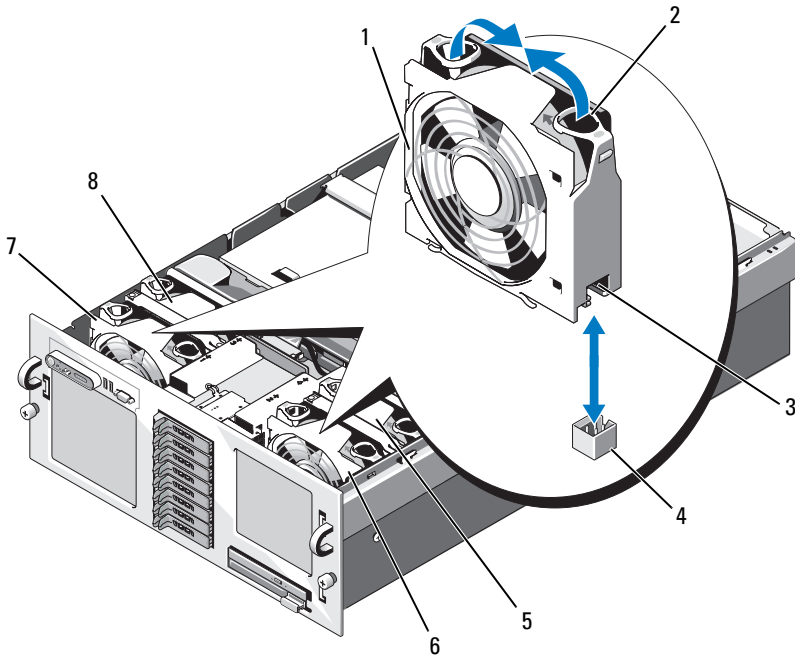
Removing a Cooling Fan

CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.

NOTE: The procedure for removing each individual fan module is the same.

1 Open the system. See "Opening the System" on page 65.

2 Compress the two latches on the top of the fan, then remove the fan. See Figure 3-4.

Figure 3-4. Removing and Replacing a Cooling Fan

1	fan	2	latches (2)
3	fan power connector	4	fan-bay power connector
5	FAN4	6	FAN2
7	FAN1	8	FAN3

Replacing a Cooling Fan

✏️ **NOTE:** The procedure for installing each individual fan is the same.

1 Ensure that the fan handle is upright and lower the fan into its retention base until the fan is fully seated. Then lower the fan handle until it snaps into place. See Figure 3-4.

2 Close the system. See "Closing the System" on page 66.
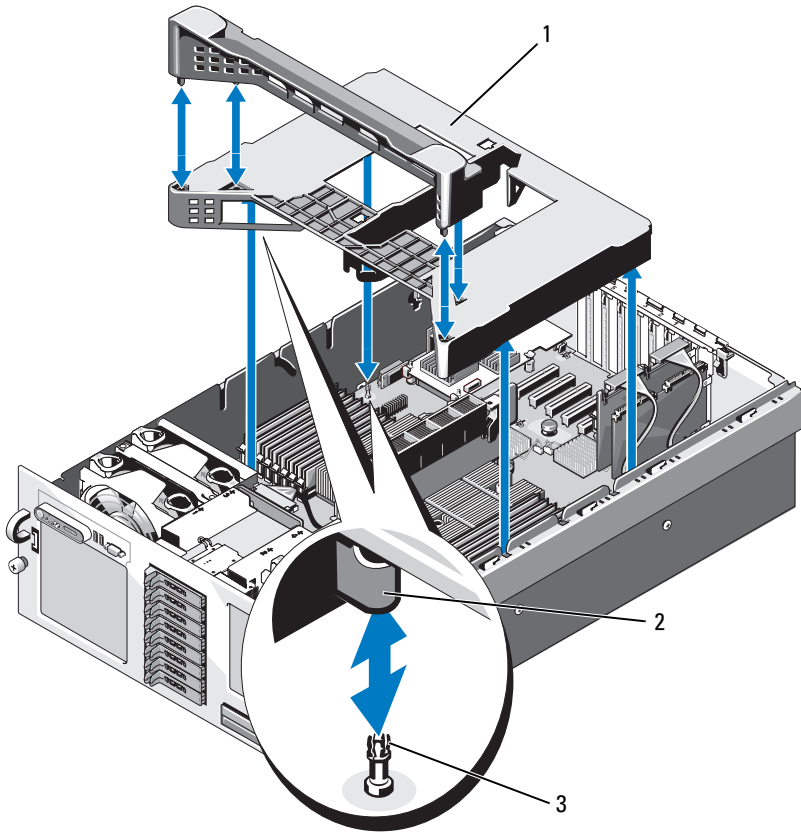
Cooling Shroud Assembly

Removing the Cooling Shroud Assembly

⊘ NOTICE: Do not operate the system without the cooling shroud assembly. The cooling shroud assembly must be installed to direct the airflow from the fans.

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the processor expansion module (PEM). See "Removing the PEM or PEM Shell" on page 73.

4 Remove the cooling shroud assembly by lifting the shroud by the corners. See Figure 3-5.

Figure 3-5. Removing and Replacing the Cooling Shroud Assembly

1	cooling shroud assembly	2	snaps (4)
3	alignment pins (4)		

Replacing the Cooling Shroud Assembly

1 Slowly lower the shroud assembly straight down into the system. The snaps on the four corners of the shroud fit over the four corresponding alignment pins on the system board. See Figure 3-5.

2 Gently press down on the shroud assembly until it is fully seated. The upper surface of the shroud should be flush with the fan bays when the shroud assembly is correctly installed.

Power Supplies

Your system supports two power supplies. The second power supply serves as a redundant, hot-plug power source.

NOTICE: The system is only in the redundant mode when two power supplies are installed and both power supplies are connected to an AC power source. If some third-party components (such as PCI cards) not tested or supported by Dell are installed, the power supplies may not be redundant at all input voltages.

NOTICE: Operating the system with only one power supply installed for extended periods of time can cause the system to overheat.
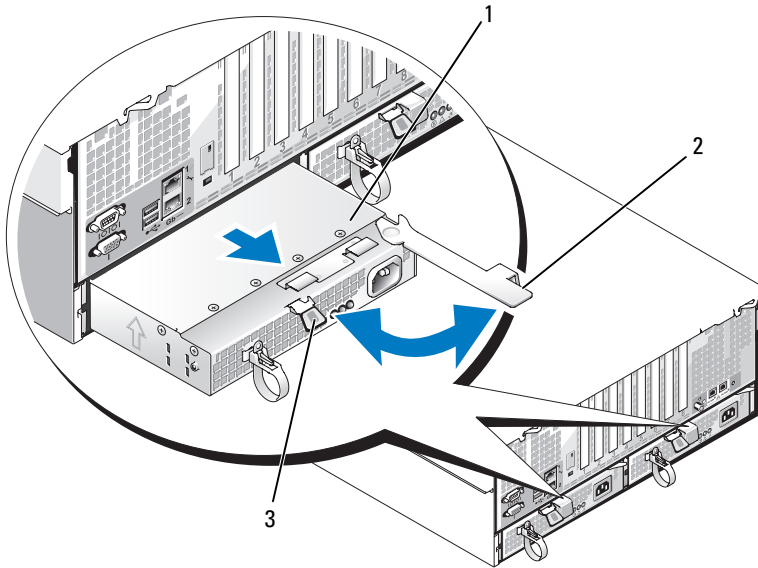
Removing a Power Supply

1 Disconnect the power cable from the power source and the power supply you intend to remove and remove the cables from the cable strain-relief loop.

2 Press the lever release latch, then open the release lever and slide the power supply out of the chassis. See Figure 3-6.

NOTE: You may have to unlatch and lift the cable management arm if it interferes with power-supply removal. For information about the cable management arm, see the system's *Rack Installation Guide*.

Figure 3-6.   Removing and Replacing a Power Supply

1	power supply	2	release lever
3	lever release latch		

Replacing a Power Supply

1   Holding the lever in the open position, slide the new power supply into the chassis until the lever contacts the system chassis. See Figure 3-6.

2   Close the release lever until the power supply is fully seated and the lever snaps into place behind the lever release latch. See Figure 3-6.

   Ø **NOTE:** If you unlatched the cable management arm in step 2 of the previous procedure, relatch it. For information about the cable management arm, see the system's *Rack Installation Guide*.

3   Connect the power cable to the power supply and plug the cable into a power outlet.

   NOTICE: When connecting the power cable, insert the cable through the strain-relief loop.

NOTE: After installing a new power supply in a system with two power supplies, allow several seconds for the system to recognize the power supply and determine its status. The power-supply status indicator turns green to signify that the power supply is functioning properly (see Figure 1-4).

Processor Expansion Module

There are two types of processor expansion module assemblies used with your system:

- If you have a four-processor system, the processor expansion module (PEM) contains a processor expansion module board with two processor sockets and 16 memory module sockets.

- If you have a two-processor system, the processor expansion module shell (PEM shell) contains an air baffle.

NOTICE: The PEM shell must be installed in a two-processor system to ensure adequate cooling airflow within the system.

Removing the PEM or PEM Shell

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Lift the handle on the PEM until the PEM is fully disengaged from the chassis. See Figure 3-7
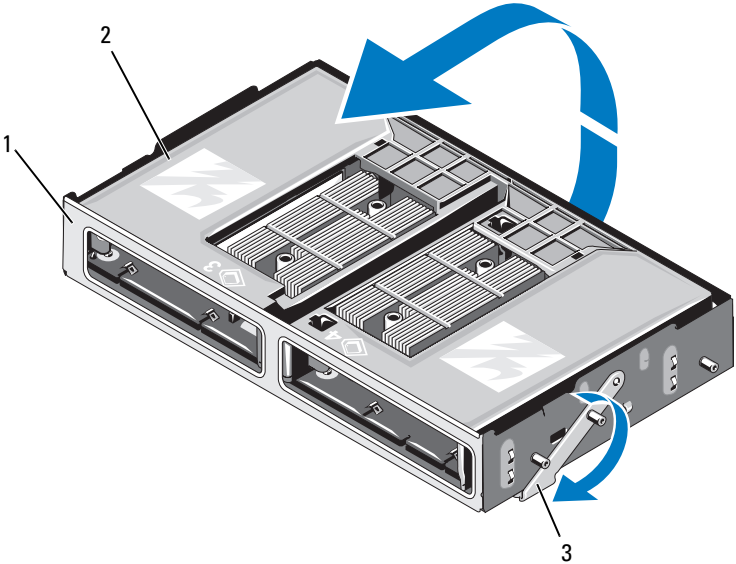
Figure 3-7. Installing and Removing a PEM
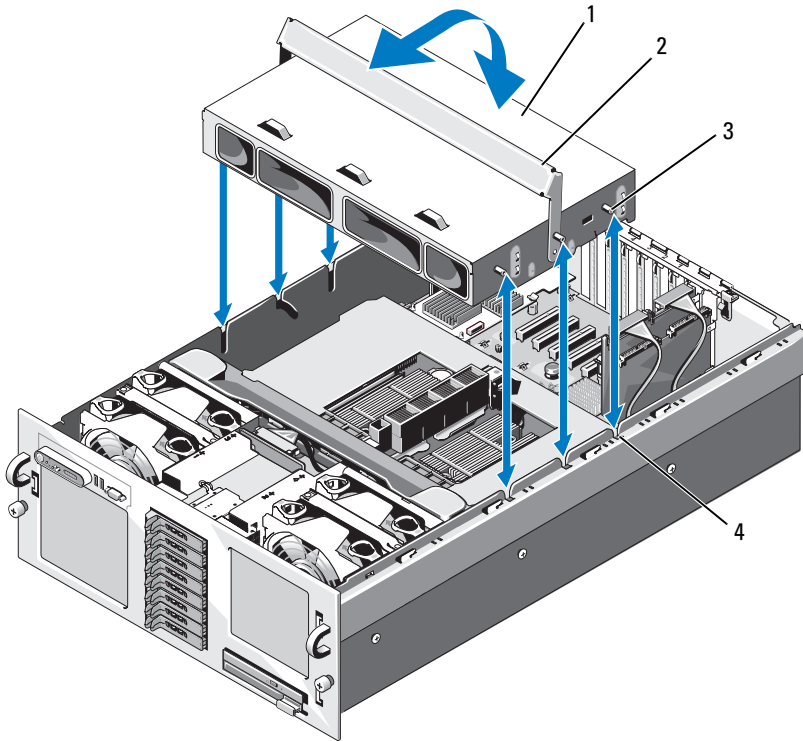
1	processor expansion module	2	handle
3	guide pins (6)	4	slots (6)

⊘ **NOTICE:** Use two hands to lift the PEM from the chassis.

4 Lift the PEM from the chassis.

5 *If you are removing a 4-processor PEM*, carefully turn the PEM upside down and rotate the handle so it is in the closed position, before placing the PEM on a work surface. See Figure 3-8.
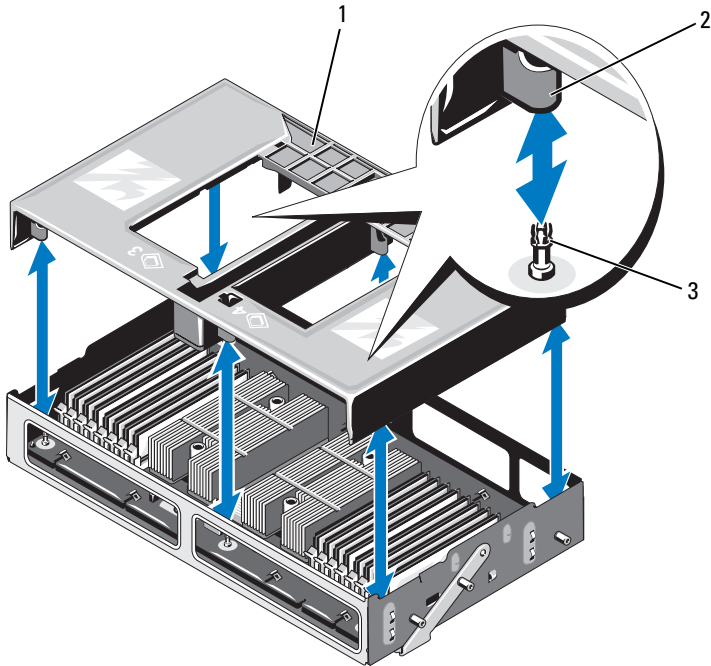
Figure 3-8. PEM in Service Position

| 1 | PEM | 2 | cooling shroud |
| 3 | handle in service position | | |

To access the PEM board, remove the cooling shroud. See Figure 3-9.

Figure 3-9. Removing and Installing the PEM Cooling Shroud

1	cooling shroud	2	alignment pins (4)
3	snaps (4)		

Replacing the PEM or PEM Shell

1 Replace the cooling shroud

2 Rotate the PEM so the PEM board (4-processor systems) or air baffles
   (2-processor systems) face downwards.

3 Rotate the PEM handle to the fully open position.

4 Align the three guide pins on each side of the PEM with the corresponding
   slots in the sides of the chassis. See Figure 3-7.

**5** Lower the PEM into the system and rotate the PEM handle until the PEM is fully seated in the chassis.

Expansion Cards

Expansion Card Installation Guidelines

Your system supports up to eight PCI-Express (PCIe) expansion cards installed in connectors on the system board (see Figure 3-10).

- All slots support full-height, half-length cards.
- Up to two 25-W cards are supported; the remaining cards must be 15-W cards.
- Slots 1, 2, 5, 6, and 7 are x4 lane-width PCIe expansion slots.
- Slots 3 and 4 are x8 lane-width PCIe expansion slots.
- One expansion slot, labeled INT_STORAGE, is reserved for the system's SAS controller card.
- If you are installing a Remote Access Control (RAC) card, it must be installed in the special card slot marked RAC_CONN. See "RAC Card" on page 83

Figure 3-10.   Expansion Slots
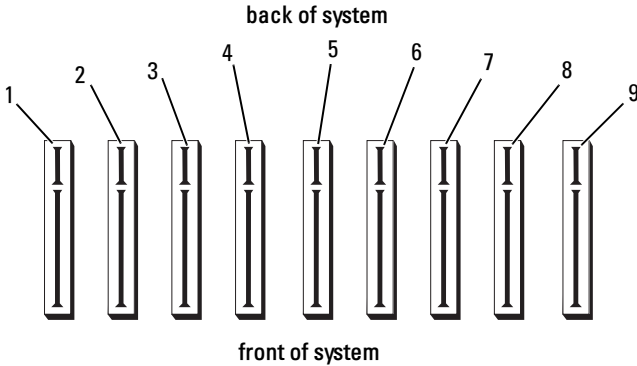
1	PCIE_X4_7	2	PCIE_X4_6
3	PCIE_X4_5	4	PCIE_X8_4
5	PCIE_X8_3	6	PCIE_X4_2
7	PCIE_X4_1	8	INT_ STORAGE
9	RAC_CONN		

Installing an Expansion Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Unpack the expansion card and prepare it for installation.

For instructions, see the documentation accompanying the card.

2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening the System" on page 65.

4 If you are adding a new card, select the appropriate expansion card slot. See "Expansion Card Installation Guidelines" on page 77.

5 Open the expansion-card retainer and remove the filler bracket. See Figure 3-11.

6 Install the expansion card:

   a Holding the card by its edges, position the card so that the card-edge connector aligns with the expansion-card connector on the system board.

NOTICE: If you are installing a SAS RAID controller card, do not press on the memory module when installing the card.

   b Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.

   c Close the expansion-card retainer. See Figure 3-11.

Figure 3-11.   Installing or Removing an Expansion Card

| 1 | expansion card | 2 | expansion-card retainer |
| 3 | card-edge connector | | |
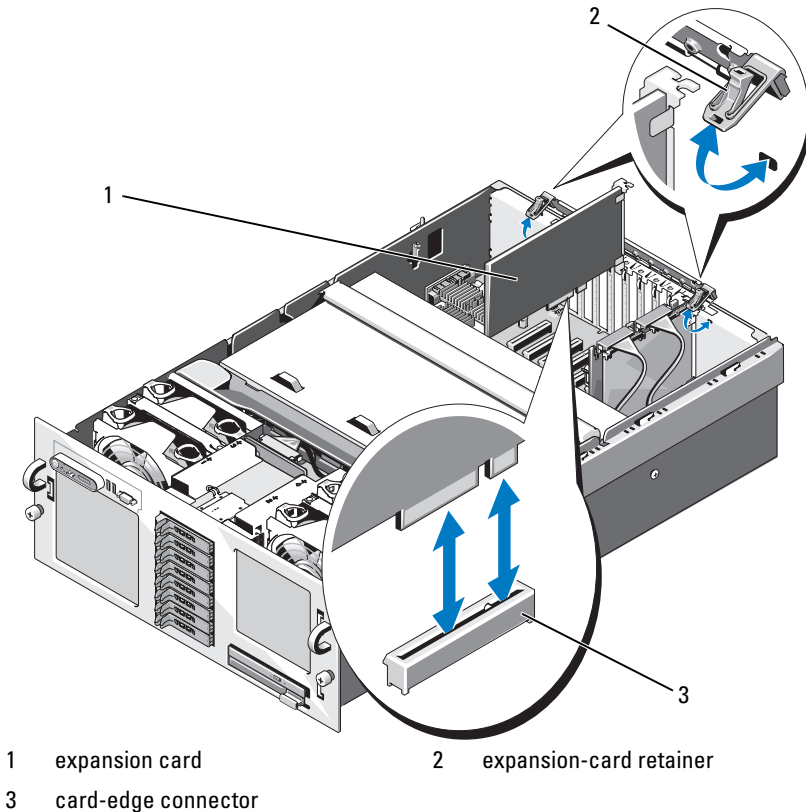
7 Connect any cables to the expansion card.

- If you are installing a RAC card, see "RAC Card" on page 83.
- If you are installing a SAS controller card, see "Installing a SAS Controller Card" on page 112.

8 Close the system. See "Closing the System" on page 66.

Removing an Expansion Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Disconnect all cables from the card.

4 Remove the expansion card:

    a Open the expansion-card retainer. See Figure 3-11.

    b Grasp the expansion card by its edges, and carefully remove it from the expansion-card connector.

5 If you are removing the card permanently, install a metal filler bracket over the empty expansion slot opening and close the expansion-card retainer.

    ✍ **NOTE:** You must install a filler bracket over an empty expansion slot to maintain Federal Communications Commission (FCC) certification of the system. The brackets also keep dust and dirt out of the system and aid in proper cooling and airflow inside the system.

6 Close the system. See "Closing the System" on page 66.

Riser Board

Two riser boards are available for your system:

- A 2-processor (2P) riser board
- A 4-processor (4P) riser board.

Figure 3-12. Riser Boards
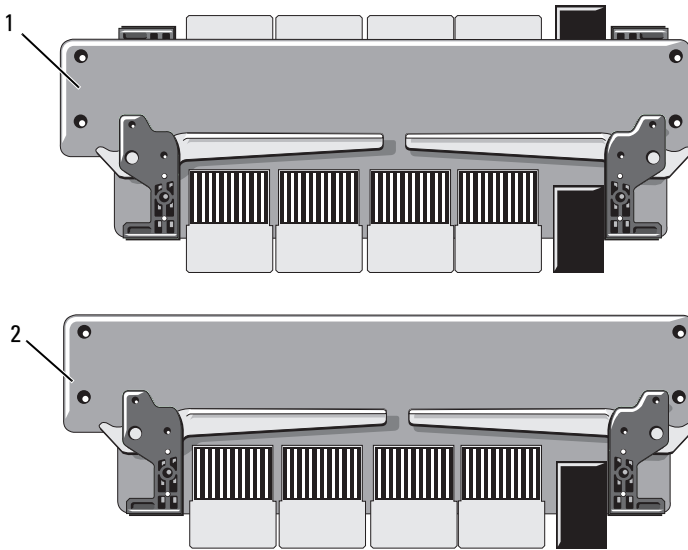

| 1 | 4-processor riser board | 2 | 2-processor riser board |

Removing the Riser Board

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

4 To remove the riser board, lift both riser retention latches until the riser is released from its socket, then lift the riser board from the chassis. See Figure 3-13.

Figure 3-13.   Installing or Removing a Riser Board
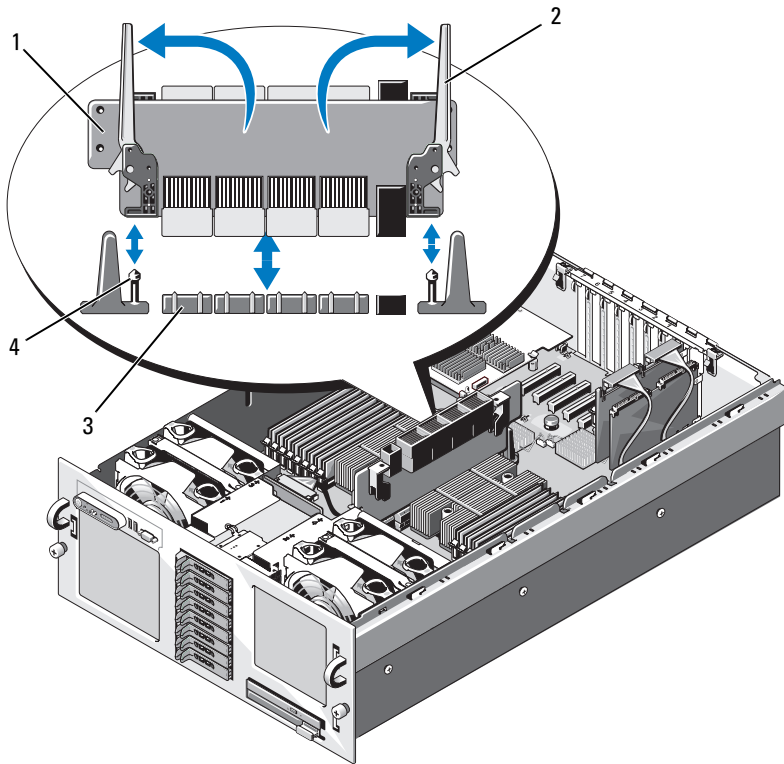
1	riser board	2	retention latches (2)
3	riser board socket	4	riser guide posts (2)

Replacing the Riser Board

1 To install the riser board, make sure both riser retention latches are completely open, then align the riser with the two riser guide posts on the system board and lower the riser board onto the system board. See Figure 3-13.

2 Close both retention latches at the same time until the latches are horizontal and the riser board is locked into place.

3 Reinstall the PEM. See "Replacing the PEM or PEM Shell" on page 76.

4 Close the system. See "Closing the System" on page 66.

5 Reconnect the system and peripherals to their power sources.

RAC Card

Installing an Optional RAC Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the plastic filler plug from the system back panel. See Figure 1-3.

4 Temporarily remove the storage controller card from the expansion slot labeled INTERNAL STORAGE:

    a Disconnect all cables from the card.

    b Grasp the storage controller card by its edges, and carefully remove it from the card connector.

5 Install the RAC card in the slot labeled RAC_CONN:

    a Angle the RAC card so that the NIC connector fits through the back-panel RAC NIC opening. See Figure 3-14.

    b Position the card so that the card-edge connector aligns with the expansion-card connector.

    c Insert the card-edge connector firmly into the expansion-card connector until the card is fully seated.

6 Connect the 50-pin management cable and the 44-pin MII cable supplied with the RAC to the two connectors on the RAC card (see Figure 3-14), and to the two corresponding connectors on the system board (see Figure 6-1).

Figure 3-14. RAC Card Connectors
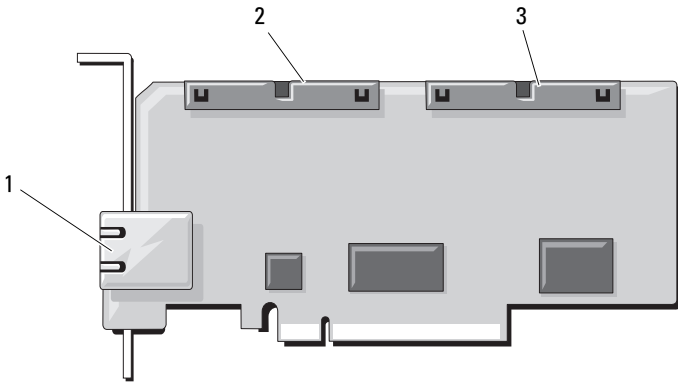
1	RJ-45 RAC NIC connector	2	44-pin MII cable connector
3	50-pin management cable connector		

7 Reinstall the storage controller card.

8 Reconnect all cables to the storage controller card.

9 Close the system. See "Closing the System" on page 66.

10 Reconnect the system and peripherals to their power sources, and turn them on.

11 Enter the System Setup program and verify that the setting for the Boot Sequence has changed to reflect the presence of the RAC card. See "Using the System Setup Program" on page 43.

12 Exit the System Setup program and reboot the system.

When the system boots, the Remote Access Controller Detected message displays and the option ROM and firmware information for the RAC displays.

Press <Ctrl><e> to enter the RAC configuration screen. See the RAC documentation for information on configuring and using the RAC.

Internal USB Memory Key (Optional)

Your system provides an internal USB connector located on the system board for use with an optional USB flash memory key (see Figure 6-1). The USB memory key can be used as a boot device, security key, or mass storage device. To use the internal USB connector, the **Internal USB Port** option must be enabled in the **Integrated Devices** screen of the System Setup program.

To boot from the USB memory key, you must configure the USB memory key with a boot image and then specify the USB memory key in the boot sequence in the System Setup program. See "Using the System Setup Program" on page 43. For information on creating a bootable file on the USB memory key, see the user documentation that accompanied the USB memory key.

Installing the Optional Internal USB Memory Key

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Locate the USB connector on the system board (see Figure 6-1).

4 Insert the USB memory key into the USB connector onto the board. See Figure 3-15.

Figure 3-15. Installing a USB Memory Key
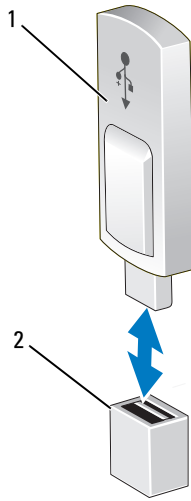
1	USB memory key	2	USB memory key connector

5 Close the system. See "Opening the System" on page 65.

6 Reconnect the system to power and restart the system.

7 Enter the System Setup program and verify that the USB key has been detected by the system. See "Using the System Setup Program" on page 43.

TOE/iSCSI Key (Optional)

TOE, iSCSI, and other future functionalities for the system's integrated NICs are enabled by installing an optional NIC hardware key in the TOE_KEY socket on the system board.

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

🖉 **NOTE:** TOE Operating system support and the Microsoft® scalable network pack are required for TOE functionality.

NOTE: When future NIC functionality is supported, you must replace the original TOE/iSCSI hardware key with a new hardware key.

1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Locate the TOE/iSCSI key connector on the system board (see Figure 6-1).

   If you have an expansion card installed in slot 7, you may have to remove the card. See "Removing an Expansion Card" on page 80.

4 Insert the TOE/iSCSI key into the connector onto the board. See Figure 3-16.

Figure 3-16.   Installing a TOE/iSCSI Key
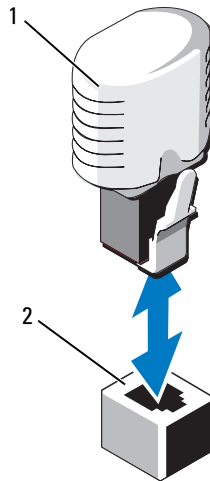
| 1 | TOE/iSCSI key | 2 | TOE/iSCSI key connector |

5 If applicable, reinstall the expansion card in slot 7. See "Installing an Expansion Card" on page 78.

6 Close the system. See "Opening the System" on page 65.

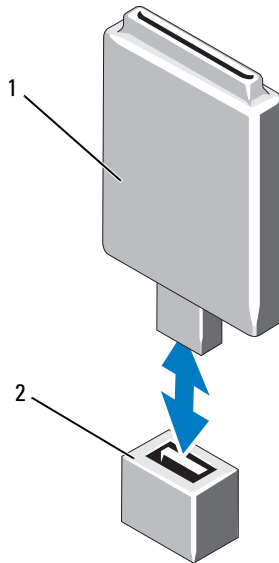7 Reconnect the system to power and restart the system.

SD Memory Card

You can install an optional SD memory card in a connector on the system board.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

 1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.

 2 Open the system. See "Opening the System" on page 65.

 3 Locate the SD card connector on the system board (see Figure 6-1).

 4 Insert the SD card connector into the connector onto the board. See Figure 3-17.

Figure 3-17.   Installing an SD Card

| 1 | SD card | 2 | SD card connector |

5 Close the system. See "Opening the System" on page 65.

6 Reconnect the system to power and restart the system.

NIC Daughter Card

The NIC daughter card provides two NICs, in addition to the two on the system board.

Installing the NIC Daughter Card

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 If you have expansion cards installed in slots 6 and 7, remove the cards temporarily to install the card. See "Removing an Expansion Card" on page 80.

4 Angle the card so that its NIC connectors are positioned toward the back-panel card opening. See Figure 3-18.

Figure 3-18. Installing and Removing a NIC Daughter Card
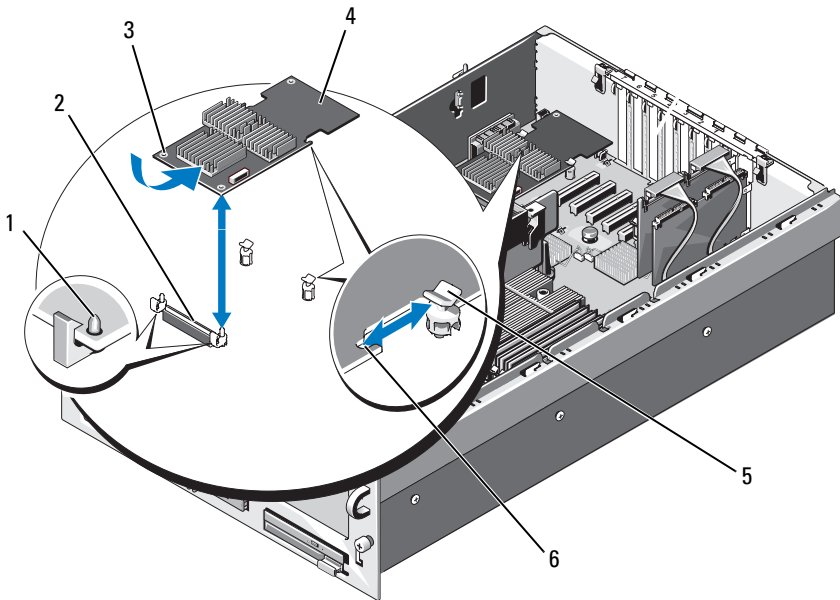
1	retention standoff (2)	2	NIC daughter card connector
3	retention standoff holes (2)	4	NIC daughter card
5	support standoff	6	cutout

5   Straighten the card so that the cutouts on the side edges of the card insert into the two support standoffs. See Figure 3-18.

6   Slide the card back slightly and align the front edge of the NIC card with the two front plastic retention standoffs adjacent to the system board connector, and press down the side of the card until it is fully seated. See Figure 3-18.

When the front of the card is fully seated, the plastic standoff snaps over the edge of the card.

7   If applicable, reinstall the expansion cards in slots 6 and 7. See "Installing an Expansion Card" on page 78.

8 Close the system. See "Opening the System" on page 65.

9 Reconnect the system to power and restart the system.

Removing the NIC Daughter Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 If you have expansion cards installed in slots 6 and 7, you must remove the cards temporarily to remove the NIC card. See "Removing an Expansion Card" on page 80.

4 Pull back slightly on the two blue retention standoff tabs at the front edge of the card and gently lift the edge of the NIC card off of the standoffs.

As the card releases from the standoffs, the connector under the NIC card disengages from the system board connector.

5 Slide the card back from the two support standoffs and lift the card out of the system.

System Memory

You can upgrade your system memory to a maximum of 128 GB (two-processor configurations) or 256 GB (four-processor configurations) by installing sets of 512-MB, 1-GB, 2-GB, 4-GB, or 8-Gb (when available) memory modules. 667-MHz registered DDR-II memory modules are supported in all memory sizes. 2-GB and 4-GB (when available) 800-Mhz memory modules are also supported in restricted configurations.

Sixteen memory sockets are located on the system board under the cooling shroud assembly. In four-processor systems, sixteen additional sockets are located on the processor expansion module board (PEM). Each processor has two memory channels, organized in sets of four memory module slots per channel.

Your system hardware supports Non-Uniform Memory Architecture (NUMA). Each processor has its own memory controller and local memory for reduced access times, but it can also access memory from another processor. This architecture improves system performance if an operating system is installed that supports this feature.

NOTICE: To enable NUMA, run the System Setup program and disable the Node Interleaving option. See "Using the System Setup Program" on page 43.

General Memory Module Installation Guidelines

To ensure optimal performance of your system, observe the following guidelines when configuring your system memory.

- Memory modules must be installed in pairs, beginning with the first two sockets in each set of memory modules. These sockets are marked by white retention levers.

- All memory modules must be identical in speed and technology. The two memory modules in each pair must be the same size.

Memory can either be installed in a two-processor configuration (Table 3-1) or a four-processor configuration (Table 3-2).

Table 3-1. Examples of Two-Processor Memory Configurations

Total System Memory	Memory Modules – Number, Size and Speed	Memory Module Locations
2 GB	Four 512 MB, 667 MHz	A1, A2, B1, B2
4 GB	Four 1 GB, 667 MHz	A1, A2, B1, B2
4 GB	Eight 512 MB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4
6 GB	Twelve 512 MB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6
8 GB	Four 2 GB, 667 MHz	A1, A2, B1, B2
8 GB	Eight 1 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4
16 GB	Four 4 GB, 667 MHz	A1, A2, B1, B2
16 GB	Eight 2 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4

Table 3-1.   Examples of Two-Processor Memory Configurations *(continued)*

Total System Memory	Memory Modules – Number, Size and Speed	Memory Module Locations
16 GB	Sixteen 1 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8
24 GB	Twelve 2 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6
32 GB	Four 8 GB, 667 MHz	A1, A2, B1, B2
32 GB	Eight 4 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4
32 GB	Sixteen 2 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8
48 GB	Twelve 4 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6
64 GB	Eight 8 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4
96 GB	Twelve 8 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6
128 GB	Sixteen 8 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8

Table 3-2.   Examples of Four-Processor Memory Configurations

Total System Memory	Memory Modules – Number, Size and Speed	Memory Module Locations
4 GB	Eight 512 MB, 667 MHz	A1, A2, B1, B2, C1, C2, D1, D2
8 GB	Eight 1 GB, 667 MHz	A1, A2, B1, B2, C1, C2, D1, D2
16 GB	Eight 2 GB, 667 MHz	A1, A2, B1, B2, C1, C2, D1, D2
16 GB	Eight 2 GB, 800 MHz*	A1, A2, B1, B2, C1, C2, D1, D2

* 2-GB 800 MHz and 4-GB 800 MHz memory modules will be supported when available 800-MHz memory modules are limited to a maximum of four modules per processor. If more than four modules are installed per processor, the system will downclock them to 667 MHz.

Table 3-2. Examples of Four-Processor Memory Configurations *(continued)*

Total System Memory	Memory Modules – Number, Size and Speed	Memory Module Locations
24 GB	Twenty-four 1 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6, C1, C2, C3, C4, C5, C6, D1, D2, D3, D4, D5, D6
32 GB	Eight 4 GB, 667 MHz	A1, A2, B1, B2, C1, C2, D1, D2
32 GB	Eight 4 GB, 800 MHz*	A1, A2, B1, B2, C1, C2, D1, D2
32 GB	Sixteen 2 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4
32 GB	Sixteen 2 GB, 800 MHz*	A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4
32 GB	Thirty-two 1 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8, C1, C2, C3, C4, C5, C6, C7, C8, D1, D2, D3, D4, D5, D6, D7, D8
48 GB	Twenty-four 2 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6, C1, C2, C3, C4, C5, C6, D1, D2, D3, D4, D5, D6
64 GB	Eight 8 GB, 667 MHz	A1, A2, B1, B2, C1, C2, D1, D2
64 GB	Sixteen 4 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4
64 GB	Sixteen 4 GB, 800 MHz*	A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4
64 GB	Thirty-two 2 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8, C1, C2, C3, C4, C5, C6, C7, C8, D1, D2, D3, D4, D5, D6, D7, D8
96 GB	Twenty-four 4 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6, C1, C2, C3, C4, C5, C6, D1, D2, D3, D4, D5, D6

* 2-GB 800 MHz and 4-GB 800 MHz memory modules will be supported when available 800-MHz memory modules are limited to a maximum of four modules per processor. If more than four modules are installed per processor, the system will downclock them to 667 MHz.

Table 3-2. Examples of Four-Processor Memory Configurations *(continued)*

Total System Memory	Memory Modules – Number, Size and Speed	Memory Module Locations
128 GB	Sixteen 8 GB, 667 MHz	A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4
128 GB	Thirty-two 4 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8, C1, C2, C3, C4, C5, C6, C7, C8, D1, D2, D3, D4, D5, D6, D7, D8
192 GB	Twenty-four 8 GB, 667 MHz	A1, A2, A3, A4, A5, A6, B1, B2, B3, B4, B5, B6, C1, C2, C3, C4, C5, C6, D1, D2, D3, D4, D5, D6
256 GB	Thirty-two 8 GB, 667 MHz	A1, A2, A3, A4, A5, A6, A7, A8, B1, B2, B3, B4, B5, B6, B7, B8, C1, C2, C3, C4, C5, C6, C7, C8, D1, D2, D3, D4, D5, D6, D7, D8

* 2-GB 800 MHz and 4-GB 800 MHz memory modules will be supported when available 800-MHz memory modules are limited to a maximum of four modules per processor. If more than four modules are installed per processor, the system will downclock them to 667 MHz.

Installing Memory Modules

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

⚠ **CAUTION: The memory modules are hot to the touch for some time after the system has been powered down. Allow time for the memory modules to cool before handling them. Handle the memory modules by the card edges and avoid touching the components on the memory module.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM (four-processor configurations) or PEM shell (two-processor configurations). See "Removing the PEM or PEM Shell" on page 73.

4 Remove the cooling shroud assembly:

   – If you are installing memory modules on the system board, see "Removing the Cooling Shroud Assembly" on page 69.

   – If you are installing memory modules on the PEM, see Figure 3-9.

5 Locate the memory module sockets. See Figure 6-1 or Figure 6-2.

6 Press the ejectors on the memory module socket down and out, as shown in Figure 3-19, to allow the memory module to be inserted into the socket.

7 Handle each memory module only on either card edge, ensuring not to touch the middle of the memory module.

Figure 3-19.   Installing and Removing a Memory Module
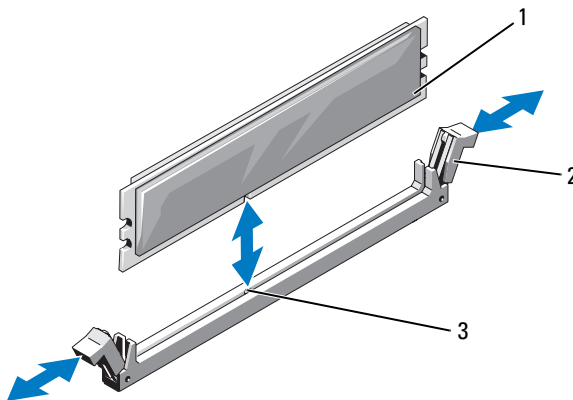
1	memory module	2	memory module socket ejectors (2)
3	alignment key		

8 Align the memory module's edge connector with the alignment key of the memory module socket, and insert the memory module in the socket.

   ✍ **NOTE:** The memory module socket has an alignment key that allows you to install the memory module in the socket in only one way.

9 Press down on the memory module with your thumbs while pulling up on the ejectors with your index fingers to lock the memory module into the socket.

When the memory module is properly seated in the socket, the ejectors on the memory module socket align with the ejectors on the other sockets that have memory modules installed.

10 Repeat step 6 through step 9 of this procedure to install the remaining memory modules. See Table 3-1 or Table 3-2.

11 Replace the cooling shroud assembly:

– If you are installing memory modules on the system board, see "Replacing the Cooling Shroud Assembly" on page 70.

– If you are installing memory modules on the PEM, see Figure 3-9.

12 Replace the PEM. See "Replacing the PEM or PEM Shell" on page 76.

13 Close the system. See "Closing the System" on page 66.

14 Start up the system, press <F2> to enter the System Setup program, and check the **System Memory** setting on the main System Setup screen.

The system should have already changed the value to reflect the newly installed memory.

15 If the value is incorrect, one or more of the memory modules may not be installed properly. Repeat step 2 through step 14 of this procedure, checking to ensure that the memory modules are firmly seated in their sockets.

16 Run the system memory test in the system diagnostics. See "Running the System Diagnostics" on page 167.

Removing Memory Modules

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

⚠ **CAUTION: The memory modules are hot to the touch for some time after the system has been powered down. Allow time for the memory modules to cool before handling them. Handle the memory modules by the card edges and avoid touching the components on the memory module.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

4 Remove the cooling shroud assembly:

  – If you are removing memory modules on the system board, see "Removing the Cooling Shroud Assembly" on page 69.

  – If you are removing memory modules on the PEM, see Figure 3-9.

5 Locate the memory module sockets. See Figure 6-1.

6 Press down and out on the ejectors on each end of the socket until the memory module pops out of the socket. See Figure 3-19.

  Handle each memory module only on either card edge, ensuring not to touch the middle of the memory module.

7 Replace the cooling shroud assembly:

  – If you are removing memory modules on the system board, see "Replacing the Cooling Shroud Assembly" on page 70.

  – If you are removing memory modules on the PEM, see Figure 3-9.

8 Replace the PEM. See "Replacing the PEM or PEM Shell" on page 76.

9 Close the system. See "Closing the System" on page 66.

Processors

Your system supports either two or four processors. You can upgrade processors to take advantage of future options in speed and functionality. Each processor and its associated internal cache memory are contained in a land grid array (LGA) package that is installed in a socket on the system board or processor expansion module.

◼ **NOTICE:** All processors must have the same frequency and core voltage.

Removing a Processor

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Prior to upgrading your system, download and install the latest system BIOS version from **support.dell.com**.

2 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening the System" on page 65.

4 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

5 Remove the cooling shroud assembly:

 – If you are removing a processor on the system board, see "Removing the Cooling Shroud Assembly" on page 69.

 – If you are removing a processor on the PEM, see Figure 3-9.

⚠️ **CAUTION: The processor and heat sink can become extremely hot. Be sure the processor has had sufficient time to cool to a lower temperature before handling.**

🔴 **NOTICE:** When you remove the heat sink, the possibility exists that the processor might adhere to the heat sink and be removed from the socket. It is recommended that you remove the heat sink while the processor is warm.

🔴 **NOTICE:** Never remove the heat sink from a processor unless you intend to remove the processor. The heat sink is necessary to maintain proper thermal conditions.

6 Loosen one of the heat-sink retention screws. See Figure 3-20.

**Figure 3-20.   Removing and Installing the Heat Sink**
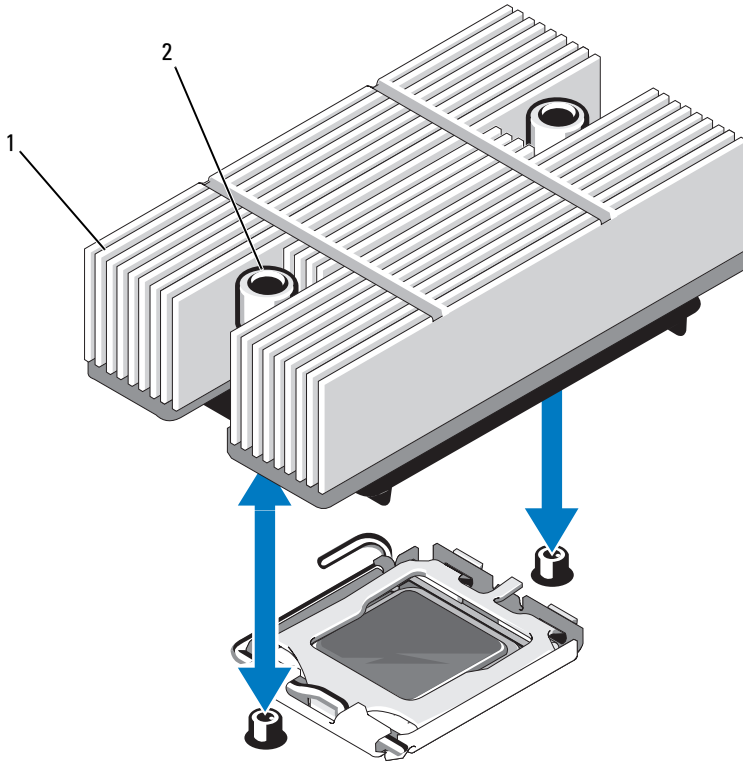
| 1 | heat sink | 2 | heat-sink retention screws (2) |

7 Wait 30 seconds for the heat sink to loosen from the processor.

8 Loosen the second heat-sink retention screw.

9 If the heat sink does not separate from the processor, carefully rotate the heat sink in a clockwise, then counterclockwise, direction until it releases from the processor. Do not pry the heat sink from the processor.

10 Lift the heat sink off of the processor and set the heat sink upside down.

11 Use a clean lint-free cloth to remove any thermal grease from the surface of the processor shield.

12 Pull the socket-release lever 90 degrees upward until the processor is released from the socket. See Figure 3-21.

Figure 3-21. Removing and Installing the Processor
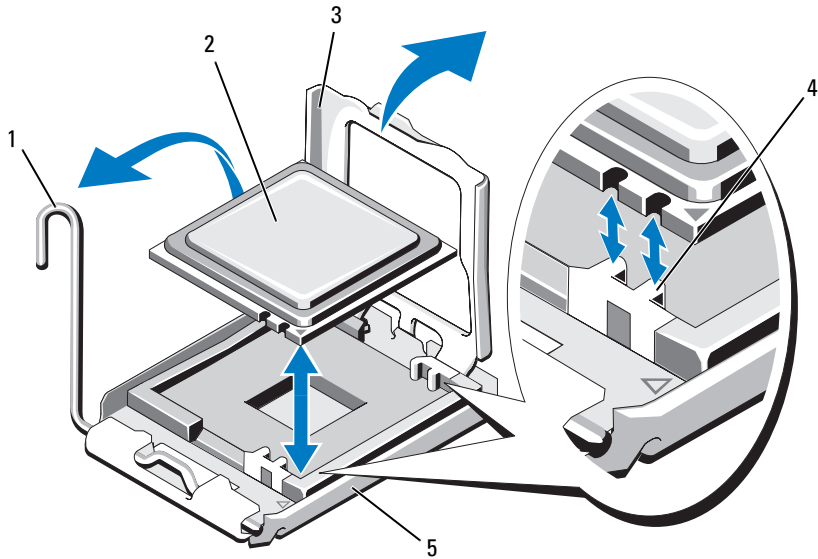
1	socket-release lever	2	processor
3	processor shield	4	socket keys (2)
5	socket		

13 Open the processor shield and then lift the processor out of the socket. Leave the release lever up so that the socket is ready for the new processor.

NOTICE: Be careful not to bend any of the pins on the socket when removing the processor. Bending the pins can permanently damage the socket and system board.

Installing a Processor

1 Unpack the new processor.

2 Align the processor with the two socket keys on the socket. See Figure 3-21.

3 If you are adding a processor to an empty socket, perform the following steps:

   a Remove the protective cover from the processor socket.

   b Pull the socket-release lever 90 degrees upward. See Figure 3-21.

   c Lift the processor shield. See Figure 3-21.

4 Install the processor in the socket.

⊗ **NOTICE:** Positioning the processor incorrectly can permanently damage the system board or the processor when you turn the system on.

   a If the release lever on the processor socket is not fully open, move it to that position.

   b With the processor and the socket keys aligned, set the processor lightly in the socket.

⊗ **NOTICE:** Do not use force to seat the processor. When the processor is positioned correctly, it fits easily into the socket.

   c Close the processor shield. See Figure 3-21.

   d Rotate the socket release lever back down until it snaps into place, securing the processor. See Figure 3-21.

5 Install the heat sink.

   ✎ **NOTE:** If you did not receive a replacement heat sink, use the heat sink that you removed in step 10.

   a If you receive a heat sink and pre-applied thermal grease with your processor kit, remove the protective sheet from the thermal grease layer on top of the heat sink. See Figure 3-20.

   If you did not receive a replacement heat sink with your processor kit, apply new thermal grease:

     • Using a clean lint-free cloth, remove the existing thermal grease from the heat sink.

     • Open the grease packet included with your processor kit and apply thermal grease evenly to the top of the processor.

   b Place the heat sink onto the processor. See Figure 3-20.

   c While pressing down on the heat, secure the heat sink by tightening the two retention screws until resistance is felt. See Figure 3-20.

6 Replace the cooling shroud assembly:

– If you are adding a processor on the system board, see "Replacing the Cooling Shroud Assembly" on page 70.

– If you are adding a processor on the PEM, see Figure 3-9.

7 Replace the PEM. See "Replacing the PEM or PEM Shell" on page 76.

8 Close the system. See "Closing the System" on page 66.

9 Restart the system.

As the system boots, it detects the presence of the new processor(s) and automatically changes the system configuration information in the System Setup program.

10 Press <F2> to enter the System Setup program, and check that the processor information matches the new system configuration.

See "Using the System Setup Program" on page 43 for instructions about using the System Setup program.

11 Run the system diagnostics to verify that the new processor operates correctly.

See "Running the System Diagnostics" on page 167 for information about running the diagnostics.

Installing an Optical Drive

The optional slimline optical drive is mounted on a tray that slides into the front panel and connects to the controller on the system board through the SAS backplane.

NOTE: DVD devices are data only.

1 Turn off the system, including any attached peripherals, and disconnect the system from its electrical outlet.

2 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

3 To remove the drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-20.

4 Remove the optical drive filler plate from the carrier:

    a Loosen the thumbscrew from the latch securing the optical drive or filler plate. See Figure 3-22.

    b Remove the latch.

    c Lift the optical drive filler plate from the carrier.

**Figure 3-22. Installing an Optical Drive in the Drive Carrier**
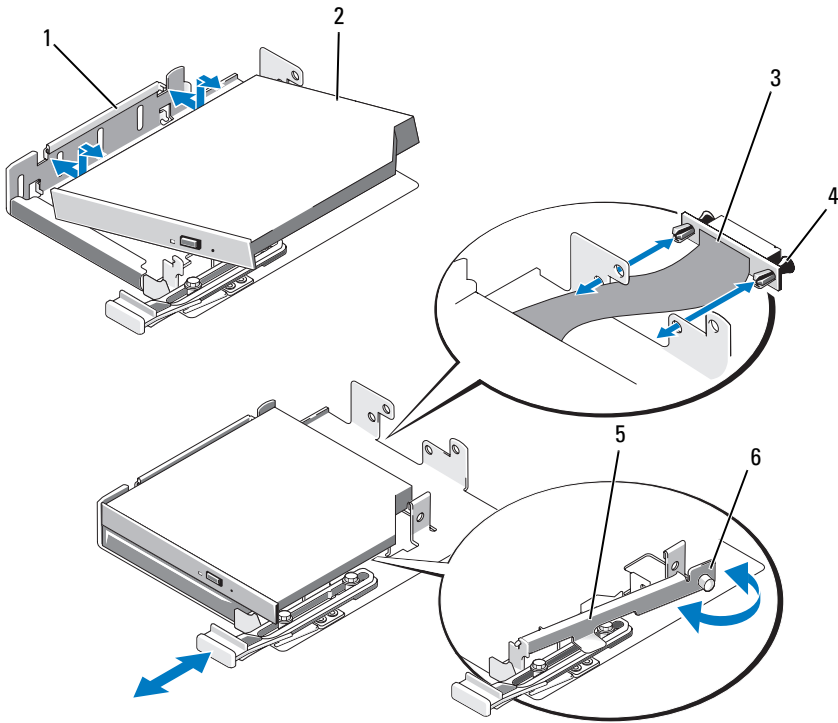
1	optical drive carrier	2	optical drive
3	interface board	4	plastic rivets (2)
5	latch	6	thumbscrew

5 Install the new optical drive in the carrier. See Figure 3-22.

The pins on the carrier fit into the corresponding holes in the side of the drive.

6 Attach the interface board to the back of the carrier, using the two plastic rivets. See Figure 3-22.

7 Reinstall the latch and tighten the thumbscrew.

8 Slide in the drive carrier until the tray snaps into place. See Figure 3-20

9 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 64.

10 Reconnect the system and peripherals to their electrical outlets.

Hard Drives

Your system can accommodate up to eight 2.5" SAS hard drives or five 3.5-inch SAS hard drives. All drives connect to the system board through a SAS backplane board. See "SAS Backplane (Service-Only Procedure)" on page 122 for information on these backplane options. Systems with an optional SAS RAID controller card support hot-plug drive operation. Figure 3-23 shows the ID numbers of the drives.

Figure 3-23. Hard-Drive ID Numbers

ID 0
ID 1
ID 2
ID 3
ID 4
ID 5
ID 6
ID 7

ID 0
ID 1
ID 2
ID 3
ID 4
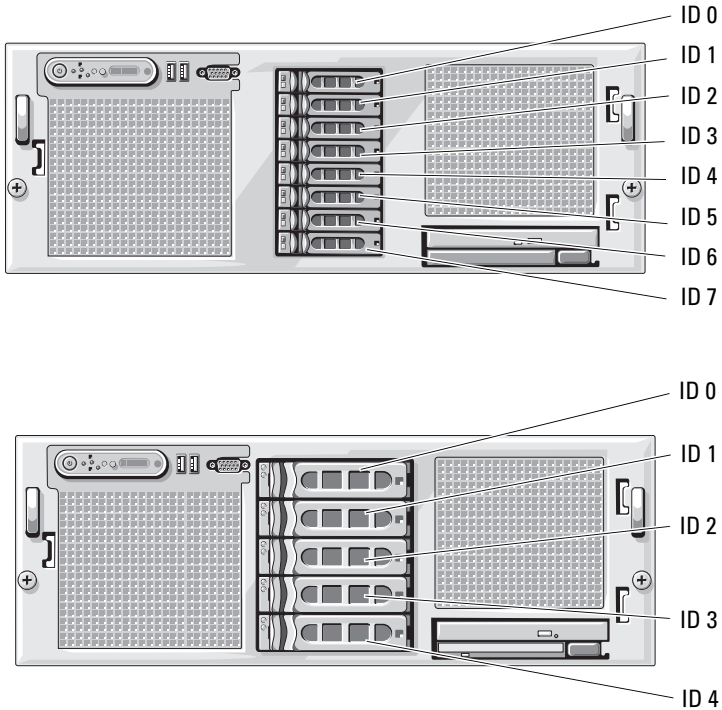
Before You Begin

NOTICE: Before you attempt to remove or install a drive while the system is running, see the documentation for the optional SAS RAID controller card to ensure that the host adapter is configured correctly to support hot-plug drive removal and insertion.

NOTE: It is recommended that you use only drives that have been tested and approved for use with the SAS backplane board.

You may need to use different programs than those provided with the operating system to partition and format the hard drives.

NOTICE: Do not turn off or reboot your system while the drive is being formatted. Doing so can cause a drive failure.

When you format a high-capacity hard drive, allow enough time for the formatting to be completed. Long format times for these drives are normal.

Configuring the Boot Device

If you plan to boot the system from a hard drive, the drive must be attached to the primary (or boot) controller. The device that the system boots from is determined by the boot order specified in the System Setup program.

The System Setup program provides options that the system uses to scan for installed boot devices. See "Using the System Setup Program" on page 43 for information about the System Setup program.

Removing a Drive Blank

NOTICE: To maintain proper system cooling, all empty hard-drive bays must have drive blanks installed. If you remove a hard-drive carrier from the system and do not reinstall it, you must replace the carrier with a drive blank.

1 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

2 Insert your finger under the shrouded end of the blank and press in on the latch to eject the blank outward from the bay.

3 Pry the ends of the blank outward until the blank is free.

Installing a Drive Blank

The drive blank is keyed to ensure correct insertion into the drive bay. To install a drive blank, insert and rotate in the keyed side of the blank into the drive bay and press evenly on the other end of the blank until it is fully inserted and latched.

Removing a Hot-Plug Hard Drive

 1 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

 2 From the RAID management software, prepare the drive for removal and wait until the hard-drive indicators on the drive carrier signal that the drive can be removed safely. See your SAS RAID controller documentation for information about hot-plug drive removal.

   If the drive has been online, the green activity/fault indicator will flash as the drive is powered down. When both drive indicators are off, the drive is ready for removal.

 3 Open the drive carrier release handle to release the drive. See Figure 3-24.

 4 Slide the hard drive out until it is free of the drive bay.

 5 If you do not replace the hard drive, insert a drive blank in the vacated drive bay. See "Installing a Drive Blank" on page 107.

 NOTICE: To maintain proper system cooling, all empty hard-drive bays must have drive blanks installed.

Figure 3-24.   Removing and Installing a Hot-Plug Hard Drive
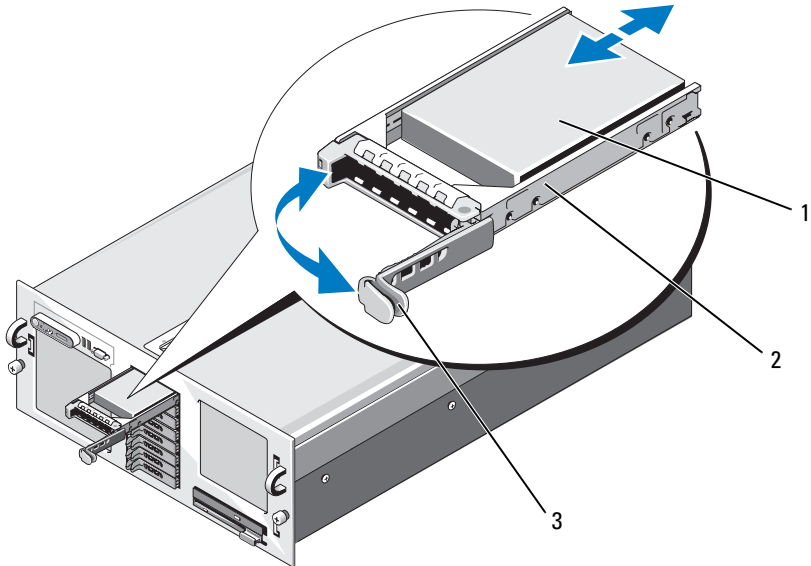
1	hard drive	2	drive carrier
3	drive carrier release handle		

Installing a Hot-Plug Hard Drive

NOTICE: When installing a hard drive, ensure that the adjacent drives are fully installed. Inserting a hard-drive carrier and attempting to lock its handle next to a partially installed carrier can damage the partially installed carrier's shield spring and make it unusable.

NOTICE: Not all operating systems support hot-plug drive installation. See the documentation supplied with your operating system.

1 Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

2 If a drive blank is present in the bay, remove it. See "Removing a Drive Blank" on page 107.

3 Install the hot-plug hard drive.

   a Open the handle on the hard-drive carrier.

   b Insert the hard-drive carrier into the drive bay until the carrier contacts the backplane.

   c Close the handle to lock the drive in place.

4 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 64.

Replacing a Hard Drive in a Hard-Drive Carrier

To remove a hard drive from a drive carrier, remove the four screws from the slide rails on the hard-drive carrier and separate the hard drive from the carrier.

To install a new hard drive in a drive carrier, perform the following steps:

1 Insert the hard drive into the hard-drive carrier with the connector end of the drive at the back. See Figure 3-25.

2 If you are installing a 3.5" drive, align the bottom rear screw hole on the hard drive with the hole labeled "SAS" on the hard drive carrier.

   When aligned correctly, the back of the hard drive will be flush with the back of the hard-drive carrier.

3 Attach the four screws to secure the hard drive to the hard-drive carrier. See Figure 3-25.

Figure 3-25.   Installing a Hard Drive Into a Drive Carrier
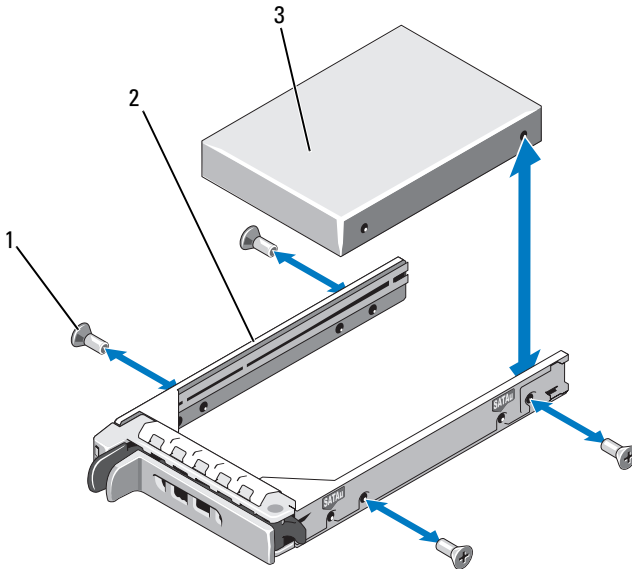
1	screws (4)	2	drive carrier
3	hard drive		

SAS Controller Cards

Removing a SAS Controller Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Disconnect the data cable(s) from the controller card.

4 If you ar removing a battery-cached SAS RAID controller, disconnect the RAID battery cable from the card.

5 Remove the card from the expansion slot.

See "Removing an Expansion Card" on page 80.

Installing a SAS Controller Card

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Install the controller card in the expansion slot labeled INTERNAL_STORAGE.

For instructions on installing the card, see "Installing an Expansion Card" on page 78.

4 Connect the card to the SAS backplane

   a Connect the SAS data cable connector labelled "Controller 0" to the white connector on the card, and the connector labelled "Controller 1" to the black connector on the card. See Figure 3-26.

   b Route the SAS data cable through the cable clips on the inner side of the chassis. Attach the connector labeled "BKPLN A" to connector SAS A on the backplane, and attach the connector labeled "BKPLN B" to connector SAS B on the backplane.

Figure 3-26.   Installing a SAS RAID Controller
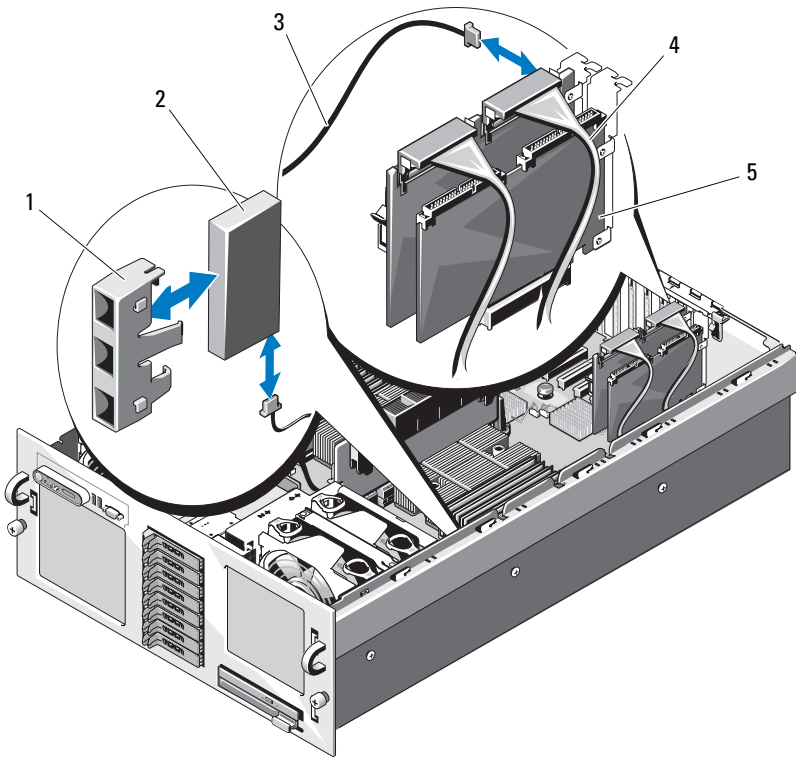
1	RAID battery holder	2	RAID battery
3	RAID battery cable	4	SAS Data cable
5	SAS RAID controller card		

Installing the SAS RAID Controller Card Battery

To install the RAID battery, insert the battery into the plastic battery holder on the inner side of the chassis, and connect the battery cable to the connector on the SAS RAID controller card next to the RAID memory module. See Figure 3-26.

Connecting an External SAS Tape Drive

This subsection describes how to connect an external SAS tape drive to the optional external SAS controller card.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

   1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

   2 Open the system. See "Opening the System" on page 65.

   3 Ground yourself by touching an unpainted metal surface on the back of the system and unpack the drive.

   4 Unpack the tape drive and controller card.

   5 Install the external SAS controller card in an expansion slot. See "Installing an Expansion Card" on page 78.

   6 Connect the tape drive's interface cable to the drive.

   7 Connect the other end of the interface cable to the external SAS connector on the controller card bracket.

   8 Connect the tape drive's power cable to an electrical outlet.

   9 Close the system. See "Closing the System" on page 66.

  10 Reconnect the system and peripherals to their electrical outlets, and turn them on.

  11 Perform a tape backup and verification test with the drive as instructed in the software documentation that came with the drive.

Connecting an External Fibre Channel Storage Device

This subsection describes how to connect external Fibre Channel devices to an optional Fibre Channel HBA card.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Ground yourself by touching an unpainted metal surface on the back of the system, unpack the drive, and compare the jumper and switch settings with those in the documentation that came with the drive.

4 Install the Fibre Channel HBA in an expansion slot. See "Installing an Expansion Card" on page 78.

5 Connect the end of the Fibre Channel cable to the connector on the HBA card bracket.

6 Close the system. See "Closing the System" on page 66.

7 Reconnect the system and peripherals to their electrical outlets, and turn them on.

System Battery

The system battery is a 3.0-volt (V), coin-cell battery.

Replacing the System Battery

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

⚠ **CAUTION: There is a danger of a new battery exploding if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions. See your *System Information Guide* for additional information.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

4 Remove the cooling shroud assembly. See "Removing the Cooling Shroud Assembly" on page 69.

5 Locate the battery socket. See Figure 6-1.

⊝ **NOTICE:** If you pry the battery out of its socket with a blunt object, be careful not to touch the system board with the object. Ensure that the object is inserted between the battery and the socket before you attempt to pry out the battery. Otherwise, you may damage the system board by prying off the socket or by breaking circuit traces on the system board.

⊝ **NOTICE:** To avoid damage to the battery connector, you must firmly support the connector while installing or removing a battery.

6 Remove the system battery. See Figure 3-27.

   a Support the battery connector by pressing down firmly on the positive side of the connector.

   b While supporting the battery connector, press the battery toward the positive side of the connector and pry it up out of the securing tabs at the negative side of the connector.

Figure 3-27. Replacing the System Battery
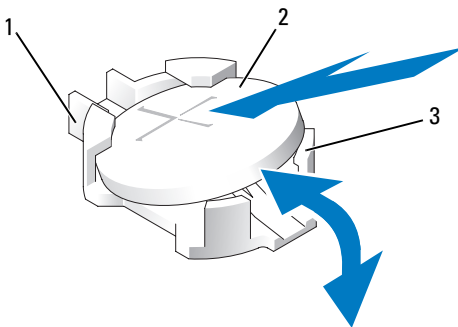
1	positive side of battery connector	2	system battery
3	negative side of battery connector		

⊝ **NOTICE:** To avoid damage to the battery connector, you must firmly support the connector while installing or removing a battery.

7 Install the new system battery.

    a Support the battery connector by pressing down firmly on the positive side of the connector.

    b Hold the battery with the "+" facing up, and slide it under the securing tabs at the positive side of the connector.

    c Press the battery straight down into the connector until it snaps into place.

8 Replace the cooling shroud assembly. See "Replacing the Cooling Shroud Assembly" on page 70.

9 Replace the PEM. See "Replacing the PEM or PEM Shell" on page 76.

10 Close the system. See "Closing the System" on page 66.

11 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

12 Enter the System Setup program to confirm that the battery is operating properly. See "Using the System Setup Program" on page 43.

13 Enter the correct time and date in the System Setup program's **Time** and **Date** fields.

14 Exit the System Setup program.

15 To test the newly installed battery, turn off the system and disconnect it from the electrical outlet for at least an hour.

16 After an hour, reconnect the system to its electrical outlet and turn it on.

17 Enter the System Setup program and if the time and date are still incorrect, see "Getting Help" on page 179 for instructions on obtaining technical assistance.

Control Panel Assembly (Service-Only Procedure)

Removing the Control Panel

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Disconnect the control panel data cable from the control panel board. See Figure 3-28.

4 Disconnect the display module cable from the control panel board. See Figure 3-28.

5 Remove the three Torx screws securing the control panel board to the system chassis and remove the board.

6 Remove the display module:

   a Insert the end of a paper clip into the hole on the right side of the display module and gently pry the label off.

   b Remove the two Torx screws that secure the display module to the system chassis.

7 Remove the display module from the chassis cutout.

Figure 3-28.   Removing and Installing the Control Panel
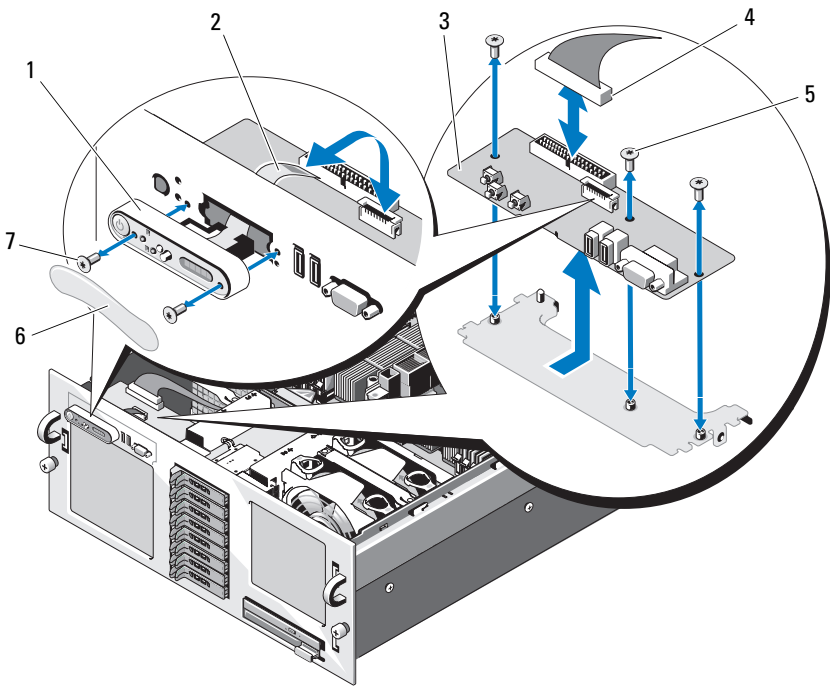
1	display module	2	display module cable
3	control panel board	4	control panel board cable
5	control panel board screws (3)	6	display module label
7	display module screws (2)		

Installing the Control Panel

1   Insert the control panel assembly display module into the chassis cutout and secure it with the two Torx screws.

2   Affix the control panel label to the display module.

3   Install the control panel board in the system chassis and secure with the three Torx screws. See Figure 3-28.

4 Connect the display module cable to the control panel board. See Figure 3-28.

5 Connect the control panel cable to the control panel board and secure the cable in the cable guides on the chassis.

6 Close the system. See "Closing the System" on page 66.

7 Replace the front bezel, if applicable. See "Removing and Replacing the Optional Front Bezel" on page 64.

8 Reconnect the system to the power source and turn on the system and attached peripherals.

Chassis Intrusion Switch (Service-Only Procedure)

Removing the Chassis Intrusion Switch

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Disconnect the intrusion-switch cable from its system board connector. See Figure 3-29.

4 Grasp the intrusion switch and slowly and firmly pull the switch out from the intrusion-switch clip.

Figure 3-29. Removing and Installing the Chassis Intrusion Switch

| 1 | intrusion switch | 2 | intrusion switch cable |

Installing the Chassis Intrusion Switch

1. Connect the intrusion-switch cable to its system board connector. See Figure 3-29.

2. Insert the switch into the opening in the chassis wall and gently, but firmly, press in the switch until it is fully seated. See Figure 3-29.

3. Close the system. See "Closing the System" on page 66.

4. Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

SAS Backplane (Service-Only Procedure)

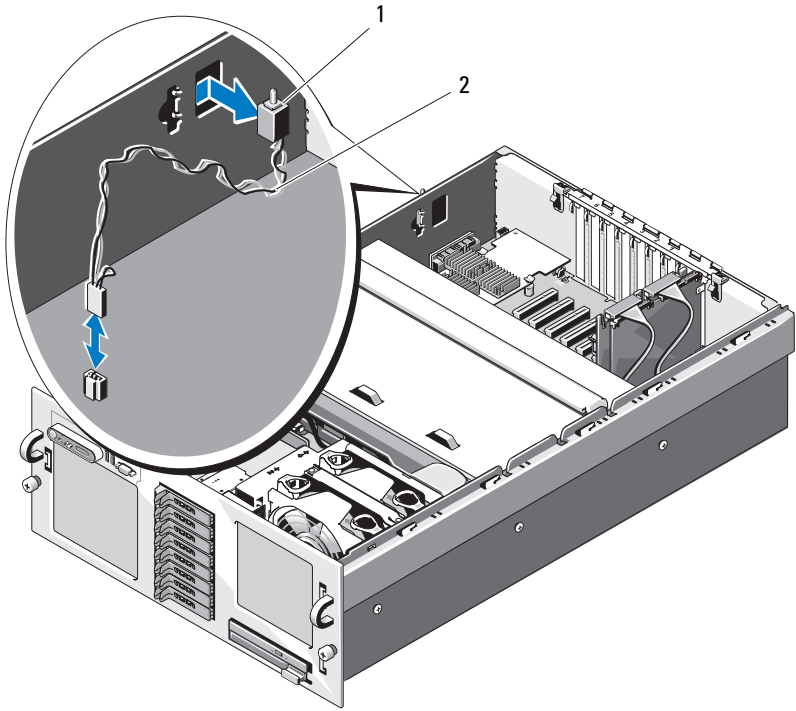## Removing the SAS Backplane

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

   1   If applicable, remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

   2   Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

   3   Open the system. See "Opening the System" on page 65.

   4   Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

   5   Remove the cooling shroud assembly. See "Removing the Cooling Shroud Assembly" on page 69.

🔘 **NOTICE:** To prevent damage to the drives and backplane, you must remove the SAS drives and optical drive carrier from the system before removing the backplane.

🔘 **NOTICE:** You must note the number of each hard drive and temporarily label them before removal so that you can replace them in the same locations.

   6   Remove all SAS hard drives. See "Removing a Hot-Plug Hard Drive" on page 108.

   7   To remove the optical drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-24.

🔘 **NOTICE:** When disconnecting the control-panel cable, hold the white pull-tab next to the control-panel cable connector to prevent damage to the SAS backplane or the cable itself.

   8   *If you are removing a 3.5-inch drive backplane,* disconnect the control-panel cable from the control-panel cable connector on the front of the backplane. See Figure 3-30.

   9   Disconnect the SAS data and power cables from the back of the SAS backplane.

10 Remove the SAS backplane from the system:

   a *If you are removing a 2.5-inch drive backplane*, press the spring-loaded blue retention tab towards the front of the system, slide the backplane upward. See Figure 3-30.

      If you are removing a 3.5-inch drive backplane, pull the spring-loaded blue retention pin away from the front of the backplane, then slide the backplane upward. See Figure 3-31.

   b When the backplane cannot slide upward any farther, pull the backplane toward the back of the system to remove it from the retention hooks.

   c Lift the board out of the system, being careful to avoid damaging components on the face of the board.

   d Place the SAS backplane face down on a work surface.

Figure 3-30.   Removing and Installing a 2.5-Inch SAS Backplane
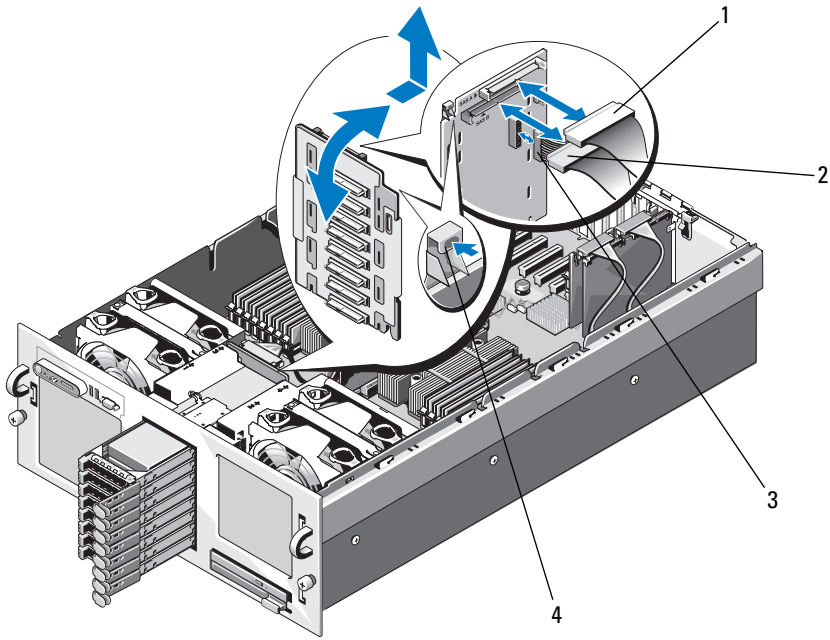
1	SAS A cable	2	SAS B cable
3	backplane power cable	4	retention tab

Figure 3-31.   Removing and Installing a 3.5" Drive SAS Backplane
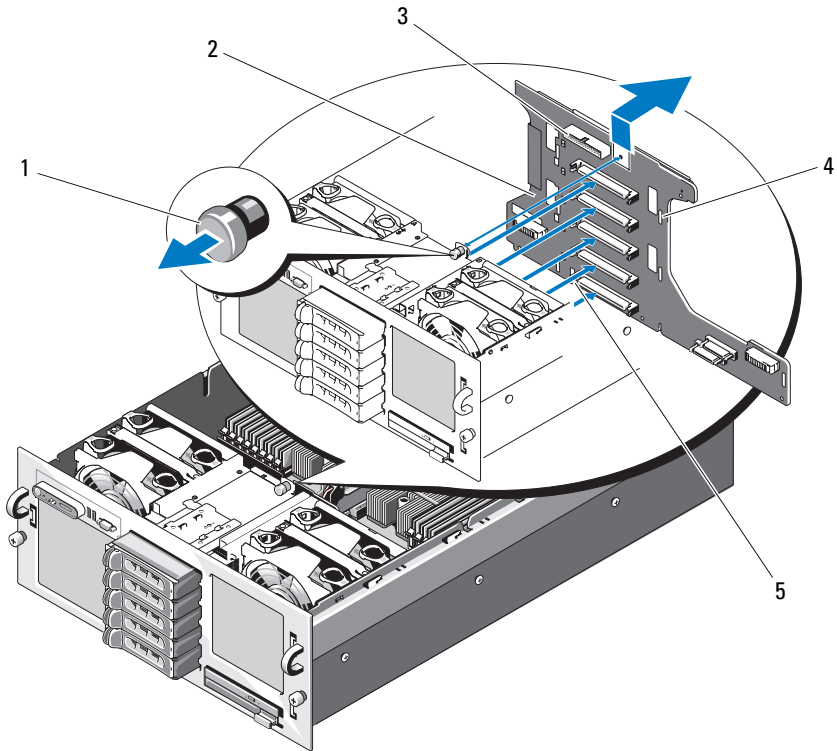
1	retention pin	2	SAS backplane
3	control-panel cable connector	4	retention slots (7)
5	installation alignment slot		

Installing a SAS Backplane

1 Install the SAS backplane:

    a Slowly lower the backplane into the system, being careful to avoid damaging components on the face of the board.

    b Align the installation alignment slot on the bottom of the backplane with the alignment pin on the bottom of the chassis. See Figure 3-31.

   c Slide the retention slots on the backplane over the retention hooks on the chassis.

   d Slide the backplane downward until the blue retention pin snaps into place.

2 Connect the SAS, interface, and power cables to the SAS backplane.

3 Connect the control-panel cable to the front of the SAS backplane.

4 Install the SAS hard drives in their original locations. See "Hard Drives" on page 105.

5 Install the optical drive carrier.

  Slide the drive carrier into its drive bay and press in the release latch. See Figure 3-20.

6 Replace the cooling shroud assembly. See "Replacing the Cooling Shroud Assembly" on page 70.

7 Replace the PEM. See "Replacing the PEM or PEM Shell" on page 76.

8 Close the system. See "Closing the System" on page 66.

9 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Peripheral Interposer Board

Removing a Peripheral Interposer Board

⚠️ **CAUTION: Any installation that requires removal of the system cover is intended solely to be performed by trained service technicians. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

4 Remove the cooling shroud assembly. See "Removing the Cooling Shroud Assembly" on page 69.

5 Disconnect the SAS data and backplane power cables from the back of the SAS backplane. See Figure 3-30 or Figure 3-31.

6 Disconnect the power cable from the top of the peripheral interposer board. See Figure 3-32.

⊘ **NOTICE:** When disconnecting the control-panel cable, hold the pull-tab on the control-panel cable connector to prevent damage to the interposer board or the cable itself.

7 Disconnect the control-panel cable from the control-panel cable connector on the back of the interposer board. See Figure 3-32.

8 Disconnect the planar interface cable from the back of the interposer board.

9 Disconnect the SATA cable from the back of the interposer board.

Figure 3-32. Removing and Installing the Peripheral Interposer Board
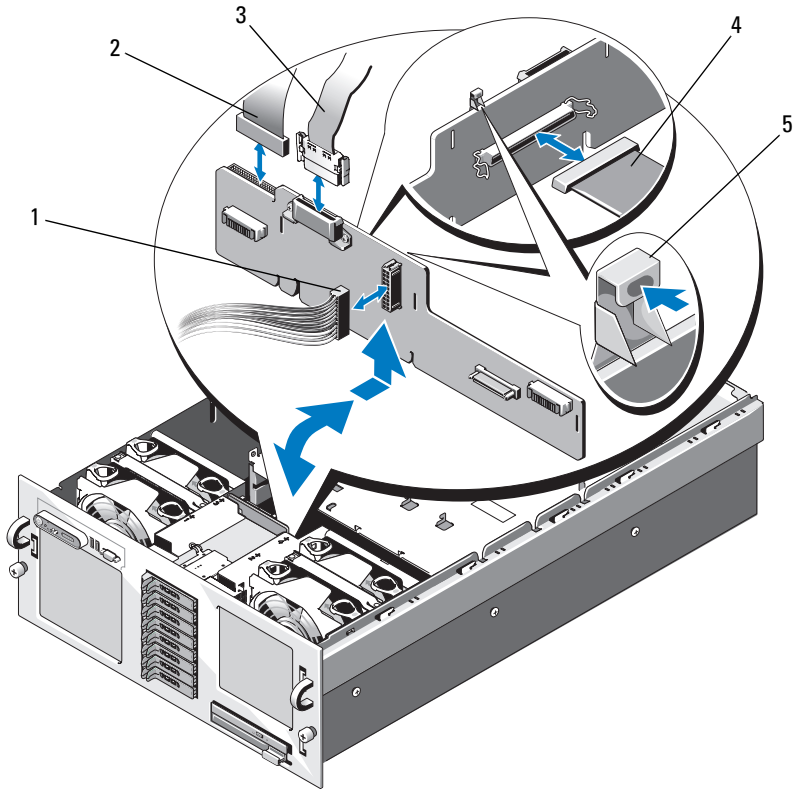
1	power cable to backplane	2	control panel cable	3	power cable from power distribution board
4	planar interface cable	5	retention tab			

10 Remove the peripheral interposer board:

    a Press the spring-loaded blue retention tab, then slide the board upward. See Figure 3-32.

    b When the board cannot move upward any farther, pull the board toward the back of the system to remove it from the retention hooks.

   c   Lift the board out of the system, being careful to avoid damaging components on the face of the board.

   d   Place the interposer board aside on a work surface.

Replacing a Peripheral Interposer Board

1 Install the peripheral interposer board:

   a   Carefully lower the interposer board into the system, being careful to avoid damaging components on the face of the board. See Figure 3-32.

   b   Align the installation alignment slot on the bottom of the interposer board with the alignment pin on the bottom of the chassis.

   c   Slide the retention slots on the interposer board over the retention hooks on the chassis.

   d   Slide the board downward until the blue retention tab snaps into place.

2 Connect the SATA, planar interface, and control panel cables to the back of the interposer board. See Figure 3-32.

3 Connect the power cable to the top of the interposer board.

4 Reconnect the SAS and backplane power cables to the back of the SAS backplane. See Figure 3-30 or Figure 3-31.

5 Replace the cooling shroud assembly. See "Replacing the Cooling Shroud Assembly" on page 70.

6 Replace the PEM. See "Replacing the PEM or PEM Shell" on page 76.

7 Close the system. See "Closing the System" on page 66.

8 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Fan Interposer Board (Service-Only Procedure)

Removing a Fan Interposer Board

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

⊘ **NOTICE:** To prevent damage to the drives and backplane, you must remove the SAS drives and optical drive carrier from the system before removing the backplane. You must note the number of each hard drive and temporarily label them before removal so that you can replace them in the same locations.

3 To remove the optical drive carrier, pull the release latch forward, then slide the carrier out of the chassis. See Figure 3-24.

4 Remove fans 1 and 3 or 2 and 4 (depending on which fan interposer board is being replaced). See "Removing a Cooling Fan" on page 67.

5 Remove the SAS backplane (systems with 3.5" hard drives) or peripheral interposer board (systems with 2.5" hard drives). See "SAS Backplane (Service-Only Procedure)" on page 122 or "Peripheral Interposer Board" on page 126.

6 Remove the two screws and remove the fan interposer board. See Figure 3-33.

Figure 3-33.   Removing and Installing a Fan Interposer Board
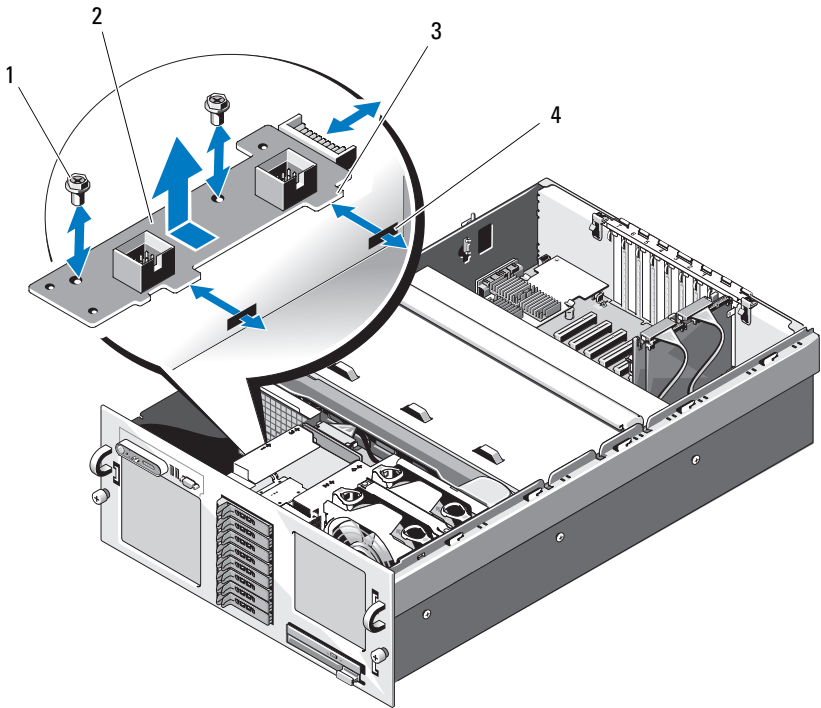
1	screws (2)	2	fan interposer board
3	tabs (2)	4	slots (2)

Installing a Fan Interposer Board

1   Slip the two securing tabs on the fan interposer board into the two slots on the side of the fan bay. See Figure 3-33.

2   Secure the fan interposer board with the two screws.

3   Replace the SAS backplane (systems with 3.5" hard drives) or peripheral interposer board (systems with 2.5" hard drives). See "SAS Backplane (Service-Only Procedure)" on page 122 or "Peripheral Interposer Board" on page 126.

4   Install the fans. See "Replacing a Cooling Fan" on page 68.

5 Install the optical drive carrier.

Slide the drive carrier into its drive bay and press in the release latch. See Figure 3-20.

6 Install the SAS hard drives in their original locations. See "Installing a Hot-Plug Hard Drive" on page 109.

7 Close the system. See "Closing the System" on page 66.

8 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

System Board (Service-Only Procedure)

Removing the System Board

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

4 Remove the cooling shroud assembly. See "Removing the Cooling Shroud Assembly" on page 69.

5 Remove all expansion cards and the SAS controller card. See "Removing an Expansion Card" on page 80.

6 If installed, disconnect and remove the RAC card.

7 If installed, remove the internal USB key and SD card.

8 If installed, remove the TOE/iSCSI key.

9 Remove the riser board. See "Removing the Riser Board" on page 81.

10 Remove the NIC daughter card. See "Removing the NIC Daughter Card" on page 91.

11 Disconnect all cables from the system board.

12 Remove the RAID battery compartment:

    a Lift the snap lever and gently pull the RAID battery compartment straight up. See Figure 3-34.

    b Lift the battery compartment away from the side of the chassis.

Figure 3-34.   Removing and Installing the RAID Battery Compartment
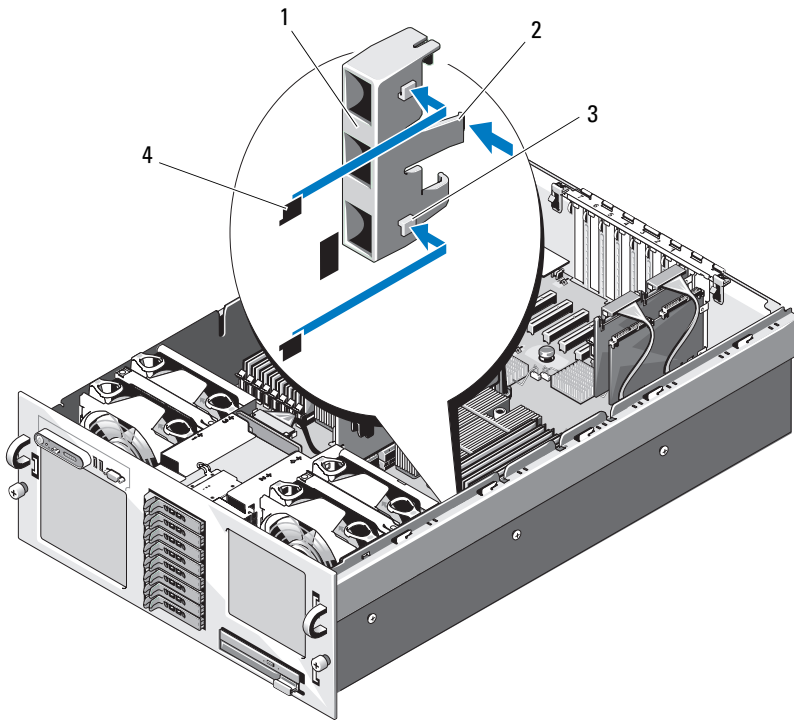
1	RAID battery compartment	2	release tab
3	securing tabs (2)	4	securing slots (2)

13 Remove the system board:

    a Pull up the spring-loaded blue retention pin located in the center of the system board, and then slide the system board toward the front of the chassis until it stops. See Figure 3-35.

b Grasp the system board by the heat sinks, or by the riser board. To avoid twisting the board, do not lift the board by the corners.

c Slowly and evenly lift the system board above the retention hooks, ensuring that the system board is clear of all retention hooks.

d Lift the system board out of the chassis.

Figure 3-35.   Removing and Installing the System Board
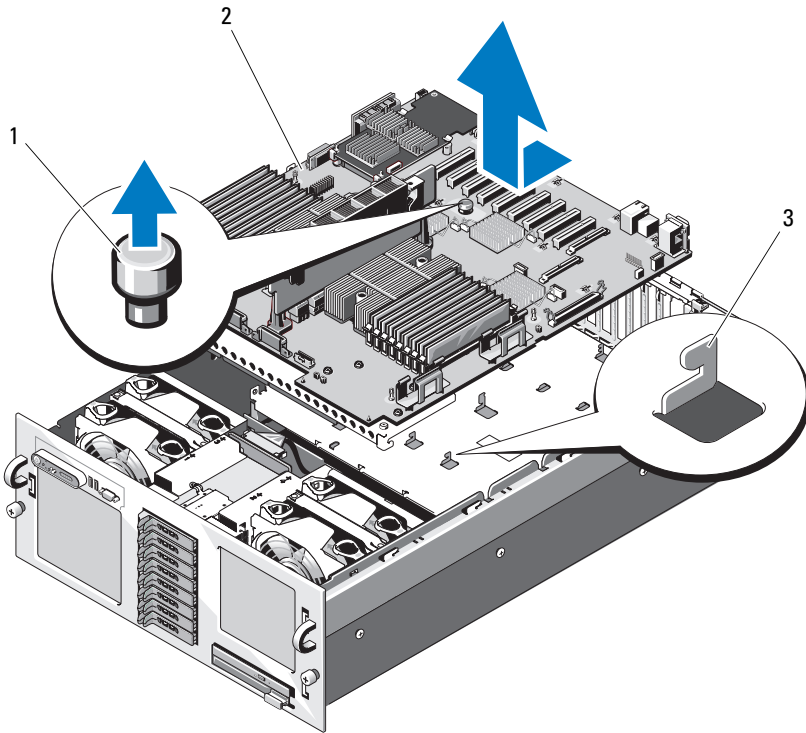
1	retention pin	2	system board
3	retention hook		

Installing the System Board

1 Transfer the processors and heat sinks to the new system board. See "Removing a Processor" on page 99 and "Installing a Processor" on page 101.

2 Remove the memory modules and transfer them to the same locations on the new board. See "Removing Memory Modules" on page 97 and "Installing Memory Modules" on page 95.

3 Transfer the riser board to the new system board. See "Removing the Riser Board" on page 81 and "Replacing the PEM or PEM Shell" on page 76.

4 Install the new system board:

    a Holding the system board by the heat sinks, lower the right side of the system board into the chassis.

    b Slowly lower the left side of the system board into the chassis.

    📝 **NOTE:** Ensure that the power cables from the power distribution board do not impede the system board as you lower the system board into the chassis.

    c Slightly lift up the front of the system board and maneuver the system board to the bottom of the chassis until it lays completely flat.

    d Ensure that all retention hooks on the bottom of the chassis are inserted into the retention slots on the system board. See Figure 3-35.

    e Push the system board toward the back of the chassis until the blue retention pin snaps into place.

5 If applicable, transfer the internal USB key, SD card, and TOE/iSCSI key.

6 Install the RAID battery compartment:

    a Insert the two securing tabs on the battery compartment into the two securing slots on the side of the chassis. See Figure 3-34.

    b Press down the battery compartment to secure it.

7 Connect the cables in the order listed below (see Figure 6-1 and Figure 6-3 for the locations of the connectors on the system board and on the SAS backplane):

• The three power distribution cables

• SAS power cable SAS backplane power connector

- Chassis intrusion switch cable
- SATA interface cable

8 Install all expansion cards. See "Installing an Expansion Card" on page 78.

9 Reinstall the SAS controller card. See "Installing a SAS Controller Card" on page 112.

10 If applicable, reconnect the RAID battery cable to the SAS controller card.

11 If applicable, reinstall and connect the RAC card. See "Installing an Optional RAC Card" on page 83.

12 Reinstall the NIC daughter card. See "Installing the NIC Daughter Card" on page 89.

13 Install the optical drive carrier.

Slide the drive carrier into its drive bay and press in the release latch. See Figure 3-20.

14 Install the SAS hard drives in their original locations. See "Installing a Hot-Plug Hard Drive" on page 109.

15 Replace the riser board.

16 Replace the cooling shroud assembly. See "Replacing the Cooling Shroud Assembly" on page 70.

17 Replace the PEM.

18 Close the system. See "Closing the System" on page 66.

19 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

20 Replace the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

Power Distribution Board (Service-Only Procedure)

Removing the Power Distribution Board

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the power supplies. See "Removing a Power Supply" on page 71.

4 Remove the system board. See "Removing the System Board" on page 132.

5 Remove the seven screws securing the board. See Figure 3-36.

6 Lift the power distribution board out of the chassis.

Figure 3-36.   Removing and Installing the Power Distribution Board
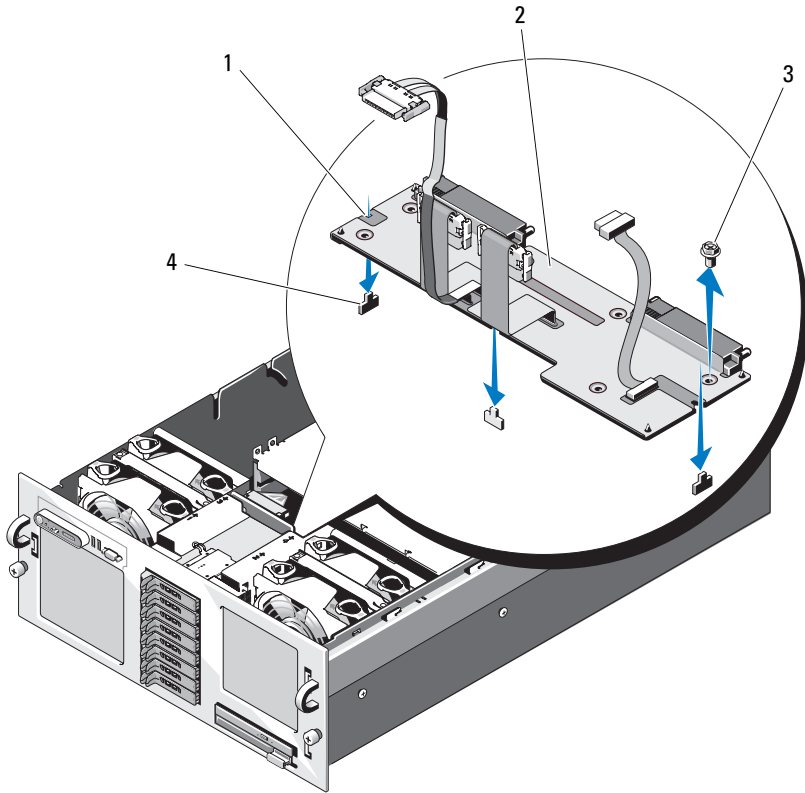
1	retention notches (3)	2	power distribution board
3	screws (7)	4	retention tabs (3)

Installing the Power Distribution Board

1   Position the three retention slots on the power distribution board with the three retention tabs on the bottom of the chassis. See Figure 3-36.

2   Secure the power distribution board with the seven screws.

3   Install the system board. See step 4 through step 14 in "Installing the System Board."

4   Install the power supplies. See "Replacing a Power Supply" on page 72.

5 Close the system. See "Closing the System" on page 66.

6 Reconnect the system to its electrical outlet and turn the system on, including any attached peripherals.

Processor Expansion Module Board (Service-Only Procedure)

Removing the PEM Board

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening the System" on page 65.

3 Remove the PEM. See "Removing the PEM or PEM Shell" on page 73.

4 Remove the PEM cooling shroud. See Figure 3-9.

5 Remove the PEM board:

   a Pull up the spring-loaded blue retention pin located in the center of the PEM board, and then slide the board toward the front of the PEM shell until it stops. See Figure 3-35.

   b Lift the PEM board out of the PEM shell.

Figure 3-37.   Removing and Installing the PEM Board
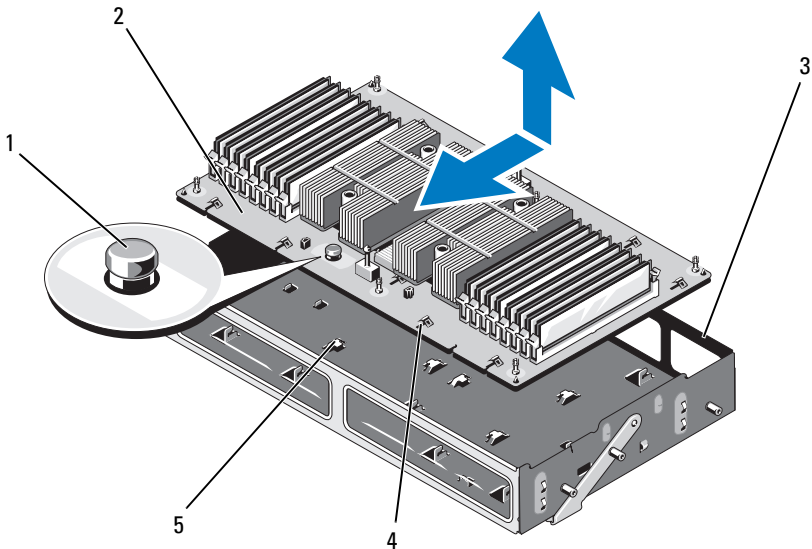
1	retention pin	2	PEM board
3	PEM shell	4	retention slots
5	retention hooks			

Replacing the PEM Board

1 Install the new PEM board:

    a Lower the PEM board into the PEM shell.

    b Ensure that the PEM board is completely parallel to the floor of the PEM shell, and that all retention hooks on the bottom of the PEM shell extend through the retention slots on the PEM board. See Figure 3-35.

    c Slide the PEM board toward the back of the PEM shell until the blue retention pin snaps into place.

2 Transfer the processors and heat sinks to the new PEM board. See "Removing a Processor" on page 99 and "Installing a Processor" on page 101.

3 Remove the memory modules and transfer them to the same locations on the new PEM board. See "Removing Memory Modules" on page 97 and "Installing Memory Modules" on page 95.

4 Replace the PEM cooling shroud. See Figure 3-9

5 Replace the PEM in the system chassis.

4

Troubleshooting Your System

Safety First—For You and Your System

To perform certain procedures in this document, you must remove the system cover and work inside the system. While working inside the system, do not attempt to service the system except as explained in this guide and elsewhere in your system documentation.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

Start-Up Routine

Look and listen during the system's start-up routine for the indications described in Table 4-1.

Table 4-1.   Start-Up Routine Indications

Look/listen for:	Action
A status or error message displayed on the front-panel LCD.	See "LCD Status Messages" on page 21.
An error message displayed on the monitor.	See "System Messages" on page 33.
Alert messages from the systems management software.	See the systems management software documentation.
The monitor's power indicator.	See "Troubleshooting the Video Subsystem" on page 145.
The keyboard indicators.	See "Troubleshooting the Keyboard or Mouse" on page 146.
The USB CD drive activity indicator.	See "Troubleshooting a USB Device" on page 149.

Table 4-1. Start-Up Routine Indications (continued)

Look/listen for:	Action
The CD drive activity indicator.	See "Troubleshooting an Optical Drive" on page 158.
The hard-drive activity indicator.	See "Troubleshooting a Hard Drive" on page 159.
An unfamiliar constant scraping or grinding sound when you access a drive.	See "Getting Help" on page 179.

Checking Basic Power Problems

1 If the power indicator on the system front panel or power supplies does not indicate that power is available to the system, ensure that the power cables are securely connected to the power supplies.

2 If the system is connected to a PDU or UPS, turn the PDU or UPS off and then on.

3 If the PDU or UPS is not receiving power, plug it into another electrical outlet. If it still is not receiving power, try another PDU or UPS.

4 Reconnect the system to the electrical outlet and turn on the system.

If the system still is not working properly, see "Troubleshooting Power Supplies" on page 154.

Checking the Equipment

This section provides troubleshooting procedures for external devices attached to the system, such as the monitor, keyboard, or mouse. Before you perform any of the procedures, see "Troubleshooting External Connections" on page 144.

Troubleshooting External Connections

Loose or improperly connected cables are the most likely source of problems for the system, monitor, and other peripherals (such as a printer, keyboard, mouse, or other external device). Ensure that all external cables are securely

attached to the external connectors on your system. See "Front-Panel Features and Indicators" on page 13 and "Back-Panel Features and Indicators" on page 18 for the front- and back-panel connectors on your system.

Troubleshooting the Video Subsystem

Problem

- Monitor is not working properly.
- Video memory is faulty.

Action

1 Check the system and power connections to the monitor.

2 Determine whether the system has an expansion card with a video output connector.

   In this system configuration, the monitor cable should normally be connected to the connector on the expansion card, *not* to the system's integrated video connector.

   To verify that the monitor is connected to the correct video connector, turn off the system and wait for 1 minute, then connect the monitor to the other video connector and turn the system on again.

3 Determine whether the system has monitors attached to both the front and back video connectors.

   The system supports only one monitor attached to either the front or back video connector. When a monitor is connected to the front panel, the back-panel video connector is disabled.

   If two monitors are attached to the system, disconnect one monitor. If the problem is not resolved, continue to the next step.

4 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

   If the test runs successfully, the problem is not related to video hardware.

   If the test fails, see "Getting Help" on page 179.

Troubleshooting the Keyboard or Mouse

Problem

- System message indicates a problem with the keyboard and/or mouse
- Keyboard and/or mouse is not functioning or is functioning improperly.

Action

1 Disconnect the keyboard and mouse cables from the system for 10 seconds and then reconnect them.

   If the problem is not resolved, proceed to the next step.

2 Try connecting the keyboard/mouse to the USB ports on the opposite side of the system. For example, if your are using the front USB ports, try connecting to the rear USB ports.

   If the problem is not resolved, proceed to the next step.

   If the problem is resolved, restart the system, enter the System Setup program, and check if the nonfunctioning USB ports are enabled. See "Getting Help" on page 179 if the ports are enabled but not functioning.

3 Swap the faulty keyboard or mouse with a working keyboard or mouse.

   If the problem is resolved, replace the faulty keyboard or mouse.

4 If other USB devices are connected to the system ports adjacent to those used by the keyboard and mouse, power down the devices and disconnect them from the system.

   An overcurrent event on another USB device can cause both the keyboard and mouse to stop functioning.

   If the mouse and keyboard do not immediately return to operation after disconnecting the other USB devices, restart your system. If the problem persists, proceed to the next step.

   If the mouse and keyboard operations are restored, reconnect the disconnected USB devices and power them on one at a time. Note if any device causes the same problem and replace any faulty device(s).

5 If you have remote access to your system, use a remote host to access the system's System Setup program and enable the USB ports. If remote access is not available, proceed to the next step.

If enabling the USB ports does not resolve the problem, see "Getting Help" on page 179.

6 If you do not have remote access to your system, use the following procedure to set the NVRAM_CLR jumper inside your system and restore the BIOS to its default settings.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

   a Turn off the system and attached peripherals and unplug the system from the power source.

   b Open the system. See "Opening the System" on page 65.

   c Locate the NVRAM_CLR jumper on your system board (see "System Board Jumpers" on page 171) and set the jumper to the enabled position.

   d Close the system. See "Closing the System" on page 66.

   e Reconnect the system and peripherals to power and restart.

   If the mouse and keyboard are operational, proceed to the next step.

   If the mouse and keyboard are still not operational, see "Getting Help" on page 179.

   f Repeat step 2 and step b.

   g Set the NVRAM_CLR jumper to the disabled position.

   h Close the system.

   i Reconnect the system to power and restart the system and attached peripherals.

   j Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled.

Troubleshooting Serial I/O Problems

Problem

- Error message indicates a problem with a serial port.
- Device connected to a serial port is not operating properly.

Action

1 Enter the System Setup program and ensure that the serial port is enabled and configured correctly for your application. See "Using the System Setup Program" on page 43.

2 If the problem is confined to a particular application, see the application documentation for specific port configuration requirements that the program may require.

3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

   If the tests run successfully but the problem persists, see Troubleshooting a Serial I/O Device.

Troubleshooting a Serial I/O Device

Problem

- Device connected to the serial port is not operating properly.

Action

1 Turn off the system and any peripheral devices connected to the serial port.

2 Swap the serial interface cable with a working cable, and turn on the system and the serial device.

   If the problem is resolved, replace the interface cable.

3 Turn off the system and the serial device, and swap the device with a comparable device.

4 Turn on the system and the serial device.

If the problem is resolved, replace the serial device. See "Getting Help" on page 179.

If the problem persists, see "Getting Help" on page 179.

Troubleshooting a USB Device

Problem

- System message indicates a problem with a USB device.
- One or more USB devices are not operating properly.

Action

1 If a single USB device is experiencing a problem, perform the following procedure. For problems with multiple USB devices, skip to step 2.

    a Turn off the USB device, disconnect the USB cable from the system briefly, and reconnect the cable.

    b Restart the system, enter the System Setup program, and ensure that all USB ports are enabled. See "Using the System Setup Program" on page 43.

    c Turn off the USB device and swap the interface cable with a working cable. Turn on the device.

       If the problem is resolved, replace the interface cable.

    d Turn off the USB device, connect it to another USB connector on the system, and turn on the USB device.

       If the USB device functions, the USB connector on the system is likely defective. Otherwise, the USB device is faulty and needs to be replaced. See "Getting Help" on page 179.

2 Power down all USB peripheral devices and disconnect all USB devices from the system except the USB mouse and keyboard.

3 Restart the system and reconnect the USB devices.

If the problem is resolved, the problem was likely caused by an overcurrent event on one of the USB devices. If the problem persists, attempt to isolate the faulty device by trying different USB configurations.

If the problem is not resolved, proceed to the next step.

4 Reset the system BIOS to the default settings by setting the NVRAM _CLR jumper inside your system. Use the following procedure.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

a Turn off the system and attached peripherals and unplug the system from the power source.

b Open the system. See "Opening the System" on page 65.

c Locate the NVRAM_CLR jumper on your system board (see "Figure 6-1) and set the jumper to the enabled position.

d Close the system. See "Closing the System" on page 66.

e Reconnect the system and peripherals to power and restart.

If all USB devices are operational, proceed to the next step.

If the USB devices are still not functioning, see "Getting Help" on page 179.

f Repeat step 2 and step b.

g Set the NVRAM_CLR jumper to the disabled position.

h Close the system.

i Reconnect the system and peripherals to power and restart.

j Enter the System Setup program and reenter any custom BIOS settings that were reset. Be sure to leave all USB ports enabled. See "Using the System Setup Program" on page 43.

If the problem persists, see "Getting Help" on page 179.

Troubleshooting a NIC

Problem

- NIC cannot communicate with network.

Action

1 Run the appropriate online diagnostic test. See "Running the System Diagnostics" on page 167.

2 Check the appropriate indicator on the NIC connector. See "NIC Indicator Codes" on page 20.

   - If the link indicator does not light, check all cable connections.

   - If the activity indicator does not light, the network driver files might be damaged or missing.

     Remove and reinstall the drivers if applicable. See the NIC documentation.

   - Change the autonegotiation setting, if possible.

   - Use another connector on the switch or hub.

   If you are using a NIC card instead of an integrated NIC, see the documentation for the NIC card.

3 Ensure that the appropriate drivers are installed and the protocols are bound. See the NIC documentation.

4 Enter the System Setup program and confirm that the NICs are enabled. See "Using the System Setup Program" on page 43.

5 Ensure that the NICs, hubs, and switches on the network are all set to the same data transmission speed. See the network equipment documentation.

6 Ensure that all network cables are of the proper type and do not exceed the maximum length. See Network Cable Requirements in your *Getting Started Guide*.

Troubleshooting a Wet System

Problem

- Liquid spilled on the system.
- Excessive humidity.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening and Closing the System" on page 65.

3 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 80.

4 Let the system dry thoroughly for at least 24 hours.

5 Close the system. See "Opening and Closing the System" on page 65.

6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

   If the system does not start properly, see "Getting Help" on page 179.

7 If the system starts properly, shut down the system and reinstall all of the expansion cards that you removed. See "Installing an Expansion Card" on page 78.

8 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

   If the test fails, see "Getting Help" on page 179.

Troubleshooting a Damaged System

Problem

- System was dropped or damaged.

Action

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Open the system. See "Opening and Closing the System" on page 65.

2 Ensure that the following components are properly installed:

- Expansion cards
- Power supplies
- Fans
- Processors and heat sinks
- Memory modules
- Drive-carrier connections to the backplane board

3 Ensure that all cables are properly connected.

4 Close the system. See "Opening and Closing the System" on page 65.

5 Run the system board tests in the system diagnostics. See "Using Dell PowerEdge Diagnostics" on page 167.

If the tests fail, see "Getting Help" on page 179.

Troubleshooting the System Battery

Problem

- System message indicates a problem with the battery.
- System Setup program loses system configuration information.
- System date and time do not remain current.

📝 **NOTE:** If the system is turned off for long periods of time (for weeks or months), the NVRAM may lose its system configuration information. This situation is caused by a defective battery.

Action

1 Re-enter the time and date through the System Setup program. See "Using the System Setup Program" on page 43.

2 Turn off the system and disconnect it from the electrical outlet for at least one hour.

3 Reconnect the system to the electrical outlet and turn on the system.

4 Enter the System Setup program.

If the date and time are not correct in the System Setup program, replace the battery. See "System Battery" on page 115.

If the problem is not resolved by replacing the battery, see "Getting Help" on page 179.

> **NOTE:** Some software may cause the system time to speed up or slow down. If the system seems to operate normally except for the time kept in the System Setup program, the problem may be caused by software rather than by a defective battery.

Troubleshooting Power Supplies

Problem

- System-status indicators are amber.
- Power-supply fault indicators are amber.
- Front-panel status LCD indicates a problem with the power supplies.

Action

1 Locate the faulty power supply.

The power supply's fault indicator is lit. See "Power Indicator Codes" on page 19.

> **NOTICE:** You can hot-plug the power supplies. One power supply must be installed for the system to operate. The system is in the redundant mode when two power supplies are installed. Remove and install only one power supply at a time in a system that is powered on. Operating the system for extended periods of time with only one power supply installed can cause the system to overheat.

2 Remove the faulty power supply. See "Power Supplies" on page 71.

3 Ensure that the power supply is properly installed by removing and reinstalling it. See "Power Supplies" on page 71.

> ![note icon] **NOTE:** After installing a new power supply, allow several seconds for the system to recognize the power supply and to determine if it is working properly. The power indicator turns green to signify that the power supply is functioning properly. See "Power Indicator Codes" on page 19.

If the problem persists, see "Getting Help" on page 179.

Troubleshooting System Cooling Problems

Problem

- Systems management software issues a fan-related error message.

Action

Ensure that none of the following conditions exist:

- System cover, cooling shroud, drive blank, or front or back filler panel is removed.
- Ambient temperature is too high.
- External airflow is obstructed.
- Cables inside the system obstruct airflow.
- An individual cooling fan is removed or has failed. See "Troubleshooting a Fan" on page 155.

Troubleshooting a Fan

Problem

- System-status indicator is amber.
- Systems management software issues a fan-related error message.
- Front panel LCD indicates a problem with the fan.
- Fan status indicator indicates a problem with the fan.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

2 Open the system. See "Opening and Closing the System" on page 65.

⚠ **CAUTION: The cooling fans are hot-pluggable. To maintain proper cooling while the system is on, only replace one fan at a time.**

3 Locate the faulty fan indicated by the LCD panel, the diagnostic software, or the fan indicator that is blinking amber. For the identification number of each fan, see Figure 3-4.

4 Ensure that the faulty fan's power cable is firmly attached to the fan power connector. For a hot-plug fan, remove and reseat the fan. See "Cooling Fans" on page 67.

   ✍ **NOTE:** Wait 30 seconds for the system to recognize the fan and determine whether it is working properly.

5 If the problem is not resolved, install a new fan. See "Cooling Fans" on page 67.

   If the replacement fan is working properly, close the system. See "Opening and Closing the System" on page 65.

   If the replacement fan does not operate, see "Getting Help" on page 179.

Troubleshooting System Memory

Problem

- Faulty memory module.
- Faulty system board.
- Front-panel status LCD indicates a problem with system memory.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 If the system is operational, run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

If diagnostics indicates a fault, follow the corrective actions provided by the diagnostic program. If the problem is not resolved or if the system is not operational, continue to the next step.

2 Turn off the system and attached peripherals, unplug the system from the power source and press the power button, and reconnect the system to power.

3 Turn on the system and attached peripherals and, as the system boots, note the messages on the screen.

If the amount of system memory detected during POST does not match the amount of memory installed or you receive a general memory error message, proceed to step 4.

If an error messages appears indicating a fault with a specific memory module, go to step 11.

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

5 Open the system. See "Opening and Closing the System" on page 65.

6 Ensure that the memory banks are populated correctly. See "General Memory Module Installation Guidelines" on page 92.

If the memory modules are populated correctly, continue to the next step.

7 Reseat the memory modules in their sockets. See "Installing Memory Modules" on page 95.

8 Close the system. See "Opening and Closing the System" on page 65.

9 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.

10 Enter the System Setup program and check the system memory setting. See "Using the System Setup Program" on page 43.

If the amount of memory installed still does not match the system memory setting, then proceed to the next step.

11 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

12 Open the system. See "Opening and Closing the System" on page 65.

Ø **NOTE:** Several configurations for memory modules exist; see ""General Memory Module Installation Guidelines" on page 92.

13 If a diagnostic test or error message indicates a specific memory module as faulty, swap or replace the module. Otherwise, swap the memory module in socket 1 with a module of the same type and capacity that is known to be good. See "Installing Memory Modules" on page 95.

14 Close the system. See "Opening and Closing the System" on page 65.

15 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals.

16 As the system boots, observe any error message that appears and the diagnostic indicators on the front of the system.

17 If the memory problem is still indicated, repeat step 11 through step 16 for each memory module installed.

If the problem persists after all memory modules have been checked, see "Getting Help" on page 179.

Troubleshooting an Optical Drive

Problem

- System cannot read data from a CD or DVD in an optical drive.

- Optical drive indicator does not blink during boot.

Ø **NOTE:** DVD devices are data only.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Try using a different CD or DVD that you know works properly.

2 Enter the System Setup program and ensure that the drive's IDE controller is enabled. See "Using the System Setup Program" on page 43.

3 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

5 Open or remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64

6 Open the system. See "Opening and Closing the System" on page 65.

7 Ensure that the interface cable is securely connected to the optical drive and to the sideplane.

8 Close the system. See "Opening and Closing the System" on page 65.

9 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem is not resolved, see "Getting Help" on page 179.

Troubleshooting a Hard Drive

Problem

- Device driver error.
- One or more hard drives not recognized by the system.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

NOTICE: This troubleshooting procedure can destroy data stored on the hard drive. Before you proceed, back up all files on the hard drive.

1. Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

   Depending on the results of the diagnostics test, proceed as needed through the following steps.

2. Remove the bezel. See "Removing and Replacing the Optional Front Bezel" on page 64.

3. If you are experiencing problems with multiple hard drives, skip to step 8. For a problem with a single hard drive, continue to the next step.

4. Turn off your system, reseat the hard drive, and restart the system.

5. If your system has a SAS RAID controller card, perform the following steps.

   a. Restart the system and press <Ctrl><C> to enter the host adapter configuration utility program.

      See the documentation supplied with the controller card for information about the configuration utility.

   b. Ensure that the hard drive has been configured correctly.

   c. Exit the configuration utility and allow the system to boot to the operating system.

6. Ensure that the required device drivers for your controller card are installed and are configured correctly. See the operating system documentation for more information.

NOTICE: Do not perform the following step if you have a SAS RAID controller card.

7. If you have the non-RAID SAS controller card, remove the hard drive and swap its drive bay location with another hard drive that is functioning properly.

   If the problem is resolved, reinstall the hard drive in the original bay. See "Installing a Hot-Plug Hard Drive" on page 109.

   If the hard drive functions properly in the original bay, the drive carrier could have intermittent problems. Replace the hard-drive carrier. See "Getting Help" on page 179.

If the hard drive functioned properly in another bay but does not function in the original bay, the SAS backplane has a defective connector. See "Getting Help" on page 179.

8 Check the cable connections inside the system:

a Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

b Open the system. See "Opening and Closing the System" on page 65.

c Verify that the cable connections between the SAS backplane and the controller card are correct. See "Installing a SAS Controller Card" on page 112.

d Verify that the data cables are securely seated in their connectors.

e Verify that the power connector on the SAS backplane is securely seated in its connector.

f Close the system. See "Opening and Closing the System" on page 65.

g Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem persists, see "Getting Help" on page 179.

Troubleshooting a SAS Controller or SAS RAID Controller

NOTE: When troubleshooting a SAS or SAS RAID controller, also see the documentation for your operating system and the controller.

Problem

• Error message indicates a problem with the SAS or SAS RAID controller.

• SAS or SAS RAID controller performs incorrectly or not at all.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostic test. See "Using Dell PowerEdge Diagnostics" on page 167.

2 Enter the System Setup program and ensure that the SAS or SAS RAID controller is enabled. See "Using the System Setup Program" on page 43.

3 Restart the system and press <Ctrl><C> to enter the configuration utility program:

   See the controller's documentation for information about configuration settings.

4 Check the configuration settings, make any necessary corrections, and restart the system.

   If the problem is not resolved, continue to the next step.

5 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

6 Open the system. See "Opening and Closing the System" on page 65.

7 Ensure that the controller card is firmly seated into the INTERNAL STORAGE system board connector. See "Installing a SAS Controller Card" on page 112.

8 If you have a SAS RAID controller, ensure that the following components are properly installed and connected:

   • Memory module
   • RAID battery

9 Verify that the cable connections between the backplane and the SAS controller are correct. See "SAS Backplane (Service-Only Procedure)" on page 122.

10 Close the system. See "Opening and Closing the System" on page 65.

11 Reconnect the system to its electrical outlet, and turn on the system and attached peripherals. If the problem persists, proceed as follows:

- If you have a SAS controller, see "Getting Help" on page 179.
- If you have a RAID controller, replace the RAID battery. See "Installing the SAS RAID Controller Card Battery" on page 113. If replacing the battery does not solve the problem, see "Getting Help" on page 179.

Troubleshooting an External SAS Tape Drive

Problem

- Defective tape drive
- Defective tape cartridge
- Missing or corrupted tape-backup software or tape drive device driver
- Defective SAS controller

Action

1 Remove the tape cartridge you were using when the problem occurred, and replace it with a tape cartridge that you know works.

2 Ensure that the device drivers for the tape drive are installed and are configured correctly.

3 Run the appropriate online diagnostics tests. See "Using Dell PowerEdge Diagnostics" on page 167.

4 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

5 Open the system. See "Opening and Closing the System" on page 65.

6 Ensure that the controller card is firmly seated in its connector on the system board.

7 Ensure that the tape drive's interface/DC power cable is connected to the tape drive and controller card.

8 Close the system. See "Opening and Closing the System" on page 65.

9 Reconnect the system to the electrical outlet, and turn on the system, including attached peripherals.

10 If the problem is not resolved, see the documentation for the tape drive for additional troubleshooting instructions.

11 Reinstall the tape-backup software as instructed in the tape-backup software documentation.

12 If you cannot resolve the problem, see "Getting Help" on page 179.

Troubleshooting Expansion Cards

📖 **NOTE:** When troubleshooting an expansion card, see the documentation for your operating system and the expansion card.

Problem
- Error message indicates a problem with an expansion card.
- Expansion card performs incorrectly or not at all.

Action

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. Before performing any procedure, see your *Product Information Guide* for complete information about safety precautions, working inside the computer and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostic test. See ""Running the System Diagnostics" on page 167.

2 Turn off the system and attached peripherals, and disconnect the system from its electrical outlet.

3 Open the system. See "Opening and Closing the System" on page 65.

4 Ensure that each expansion card is firmly seated in its connector. See "Expansion Cards" on page 77.

5 Close the system. See "Opening and Closing the System" on page 65.

6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

If the problem persists, go to the next step.

7 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

8 Open the system. See "Opening and Closing the System" on page 65.

9 Remove all expansion cards installed in the system. See "Removing an Expansion Card" on page 80

10 Close the system. See "Opening and Closing the System" on page 65.

11 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

12 Run the appropriate online diagnostic test.

If the test fails, see "Getting Help" on page 179.

13 For each expansion card you removed in step 9, perform the following steps:

  a Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

  b Open the system. See "Opening and Closing the System" on page 65.

  c Reinstall one of the expansion cards. See "Installing an Expansion Card" on page 78.

  d Close the system. "Opening and Closing the System" on page 65.

  e Run the appropriate diagnostic test.

  If the test fails, see "Getting Help" on page 179.

Troubleshooting the Microprocessors

Problem

- Error message indicates a processor problem.
- Front-panel status LCD indicates a problem with the processors or system board.
- A heat sink is not installed for each processor.

Action

⚠️ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Run the appropriate online diagnostics test. See "Using Dell PowerEdge Diagnostics" on page 167.

2 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

3 Open the system. See "Opening and Closing the System" on page 65.

4 Ensure that each processor and heat sink are properly installed. See "Removing a Processor" on page 99.

5 Close the system. See "Opening and Closing the System" on page 65.

6 Reconnect the system to the electrical outlet, and turn on the system and attached peripherals.

7 Run the appropriate online diagnostic test.

   If the test fails or the problem persists, continue to the next step.

8 Turn off the system and attached peripherals, and disconnect the system from the electrical outlet.

9 Open the system. See "Opening and Closing the System" on page 65.

10 Replace processor 1 with another processor of the same type. See "Removing a Processor" on page 99 and "Installing a Processor" on page 101.

11 Close the system. See "Opening and Closing the System" on page 65.

12 Run the appropriate online diagnostic test.

   If the tests complete successfully, replace processor 1. See "Getting Help" on page 179.

   If the test fails, see "Getting Help" on page 179.

5

Running the System Diagnostics

If you experience a problem with your system, run the diagnostics before calling for technical assistance. The purpose of the diagnostics is to test your system's hardware without requiring additional equipment or risking data loss. If you are unable to fix the problem yourself, service and support personnel can use diagnostics test results to help you solve the problem.

Using Dell PowerEdge Diagnostics

To assess a system problem, first use the online Dell™ PowerEdge™ Diagnostics. Dell PowerEdge Diagnostics is a suite of diagnostic programs, or test modules, that include diagnostic tests on chassis and storage components such as hard drives, physical memory, communications and printer ports, NICs, CMOS, and more. If you are unable to identify the problem using the PowerEdge Diagnostics, then use the system diagnostics.

The files required to run PowerEdge Diagnostics for systems running supported Microsoft® Windows® and Linux operating systems are available at **support.dell.com** and on the CDs that came with your system. For information about using diagnostics, see the *Dell PowerEdge Diagnostics User's Guide*.

System Diagnostics Features

The system diagnostics provides a series of menus and options for particular device groups or devices. The system diagnostics menus and options allow you to:

- Run tests individually or collectively.
- Control the sequence of tests.
- Repeat tests.
- Display, print, or save test results.
- Temporarily suspend testing if an error is detected or terminate testing when a user-defined error limit is reached.
- View help messages that briefly describe each test and its parameters.

- View status messages that inform you if tests are completed successfully.
- View error messages that inform you of problems encountered during testing.

When to Use the System Diagnostics

If a major component or device in the system does not operate properly, component failure may be indicated. As long as the microprocessor and the system's input/output devices (monitor, and keyboard) are functioning, you can use the system diagnostics to help identify the problem.

Running the System Diagnostics

The system diagnostics is run from the utility partition on your hard drive.

NOTICE: Use the system diagnostics to test only your system. Using this program with other systems may cause invalid results or error messages. In addition, use only the program that came with your system (or an updated version of that program).

1 As the system boots, press <F10> during POST.

2 From the utility partition main menu, select **Run System Diagnostics**, or select **Run Memory Diagnostics** if you are troubleshooting memory.

When you start the system diagnostics, a message is displayed stating that the diagnostics are initializing. Next, the **Diagnostics** menu appears. The menu allows you to run all or specific diagnostics tests or to exit the system diagnostics.

NOTE: Before you read the rest of this section, start the system diagnostics so that you can see the utility on your screen.

System Diagnostics Testing Options

Click the testing option in the **Main Menu** window. Table 5-1 provides a brief explanation of testing options.

Table 5-1. System Diagnostics Testing Options

Testing Option	Function
Express Test	Performs a quick check of the system. This option runs device tests that do not require user interaction. Use this option to quickly identify the source of your problem.
Extended Test	Performs a more thorough check of the system. This test can take an hour or longer.
Custom Test	Tests a particular device.
Information	Displays test results.

Using the Custom Test Options

When you select **Custom Test** in the **Main Menu** window, the **Customize** window appears and allows you to select the device(s) to be tested, select specific options for testing, and view the test results.

Selecting Devices for Testing

The left side of the **Customize** window lists devices that can be tested. Devices are grouped by device type or by module, depending on the option you select. Click the (+) next to a device or module to view its components. Click (+) on any component to view the tests that are available. Clicking a device, rather than its components, selects all of the components of the device for testing.

Selecting Diagnostics Options

Use the **Diagnostics Options** area to select how you want to test a device. You can set the following options:

- **Non-Interactive Tests Only** — When checked, runs only tests that require no user intervention.

- **Quick Tests Only** — When checked, runs only the quick tests on the device. Extended tests will not run when you select this option.

- **Show Ending Timestamp** — When checked, time stamps the test log.

- **Test Iterations** — Selects the number of times the test is run.

- **Log output file pathname** — When checked, enables you to specify where the test log file is saved.

Viewing Information and Results

The tabs in the **Customize** window provide information about the test and the test results. The following tabs are available:

- **Results** — Displays the test that ran and the result.
- **Errors** — Displays any errors that occurred during the test.
- **Help** — Displays information about the currently selected device, component, or test.
- **Configuration** — Displays basic configuration information about the currently selected device.
- **Parameters** — If applicable, displays parameters that you can set for the test.

6

Jumpers and Connectors

This section provides specific information about the system jumpers. It also provides some basic information on jumpers and switches and describes the connectors on the various boards in the system.

System Board Jumpers

Figure 6-1 shows the location of the configuration jumpers on the system board. Table 6-1 lists the jumper settings.

Table 6-1.   System Board Jumper Settings

Jumper	Setting		Description
PWRD_EN	⊙▣	(default)	The password feature is enabled (pins 2-4)
	▣⊙		The password feature is disabled (pins 4-6)
NVRAM_CLR	▣⊙	(default)	The configuration settings are retained at system boot (pins 3-5)
	⊙▣		The configuration settings are cleared at the next system boot (pins 1-3)

Disabling a Forgotten Password

The system's software security features include a system password and a setup password, which are discussed in detail in "Using the System Setup Program" on page 43. The password jumper enables these password features or disables them and clears any password(s) currently in use.

⚠ **CAUTION: Only trained service technicians are authorized to remove the system cover and access any of the components inside the system. See your *Product Information Guide* for complete information about safety precautions, working inside the computer, and protecting against electrostatic discharge.**

1 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

2 Open the system. See "Opening and Closing the System" on page 65.

3 Move the password jumper to pins 2-4 to clear the password.

See Figure 6-1 to locate the password jumper on the system board.

4 Close the system.

5 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

The existing passwords are not disabled (erased) until the system boots with the password jumper plug removed. However, before you assign a new system and/or setup password, you must install the jumper plug.

NOTE: If you assign a new system and/or setup password with the jumper plug still removed, the system disables the new password(s) the next time it boots.

6 Turn off the system, including any attached peripherals, and disconnect the system from the electrical outlet.

7 Open the system. See "Opening and Closing the System" on page 65.

8 Move the password jumper to pins 4-6 to restore the password function.

9 Close the system.

10 Reconnect your system and peripherals to their electrical outlets, and turn on the system.

11 Assign a new system and/or setup password.

To assign a new password using the System Setup program, see "Assigning a System Password" on page 55.

System Board Connectors

See Figure 6-1 and Table 6-2 for the location and description of the system board connectors.

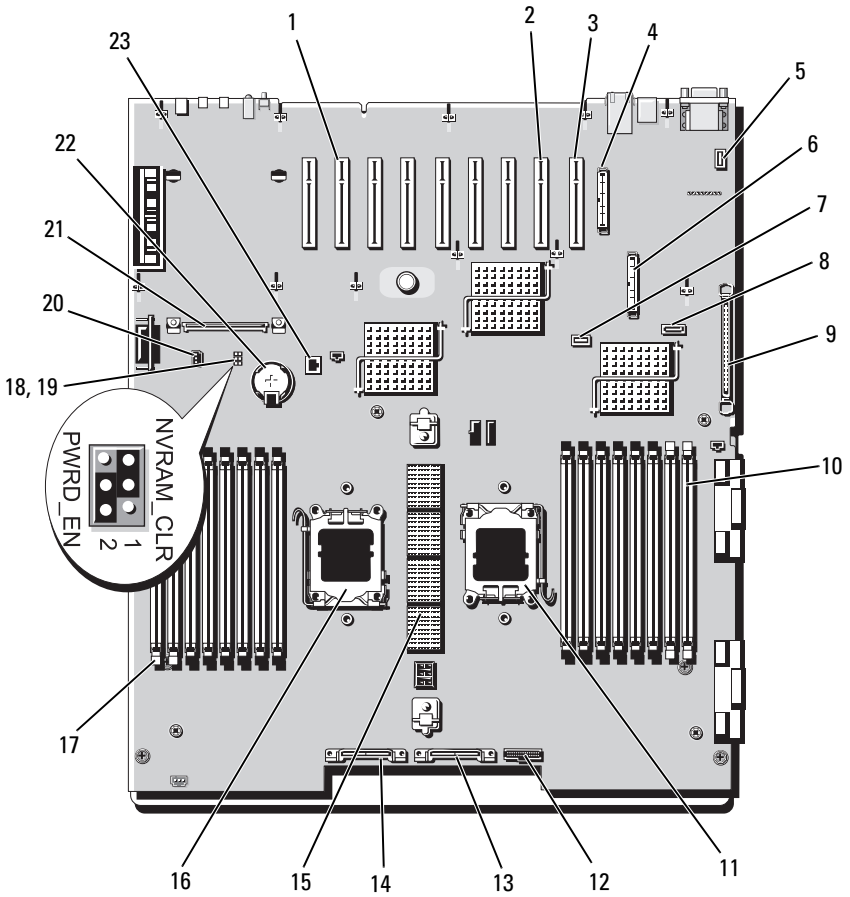**Figure 6-1.** **System Board Connectors**

Labels on the figure:

- 23
- 22
- 21
- 20
- 18, 19
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 17
- 16
- 15
- 14
- 13
- 12
- 11

NVRAM_CLR

PWRD_EN

1
2

Table 6-2.   System Board Connectors

	Connector Label	Description
1	PCIE_X*n*_*n*	PCIe expansion slots (7)
2	INT_STORAGE	SAS controller card connector
3	RAC_CONN	remote access card connector
4	RAC_CONN2	connector for the 40-pin RAC cable
5	INT_SD	SD card connector
6	RAC_CONN1	remote access card (RAC) connector
7	INT_USB	internal USB connector
8	SATA	SATA controller connector
9	CONTROL_PANEL	control panel cable connector
10	A*n*	memory module connectors (8)
11	CPU1	processor 1 socket
12	PWR_3.3Stby_Cntrl	Power distribution board signal connector
13	GROUND	Power distribution board signal connector
14	12V	12-V power connector
15	CONN_J*n*	riser card connector (5)
16	CPU2	processor 2 socket
17	B*n*	memory module connectors (8)
18	PWRD_EN	password jumper
19	NVRAM_CLR	configuration jumper
20	Intrusion Detection	intrusion switch connector
21	LOM Mezzanine Card	NIC daughter card connector
22	BATTERY	connector for the 3.0-V coin battery
23	TOE KEY	TOE/iSCSI key connector

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 181.

Processor Expansion Module Board Connectors

See Figure 6-2 and Table 6-3 for the location and description of the PEM board connectors.

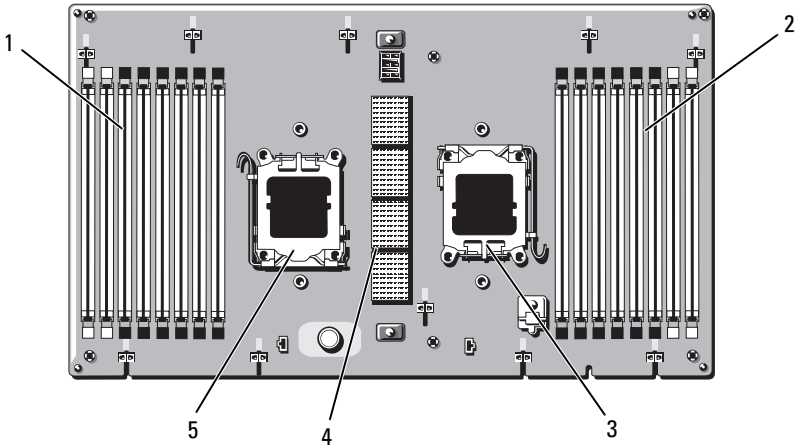**Figure 6-2.   Processor Expansion Module Board Connectors**

**Table 6-3.   Processor Expansion Module Board Connectors**

Connector Label		Description
1	C*n*	memory module connectors (8)
2	D*n*	memory module connectors (8)
3	CPU4	processor 4 socket
4	CONN_J*n*	riser card connector (5)
5	CPU3	processor 3 socket

NOTE: For the full name of an abbreviation or acronym used in this table, see the "Glossary" on page 181.

SAS Backplane Board Connectors

Figure 6-3 shows the location of the connectors on the backplane board.

Figure 6-3.   SAS Backplane Board Connectors
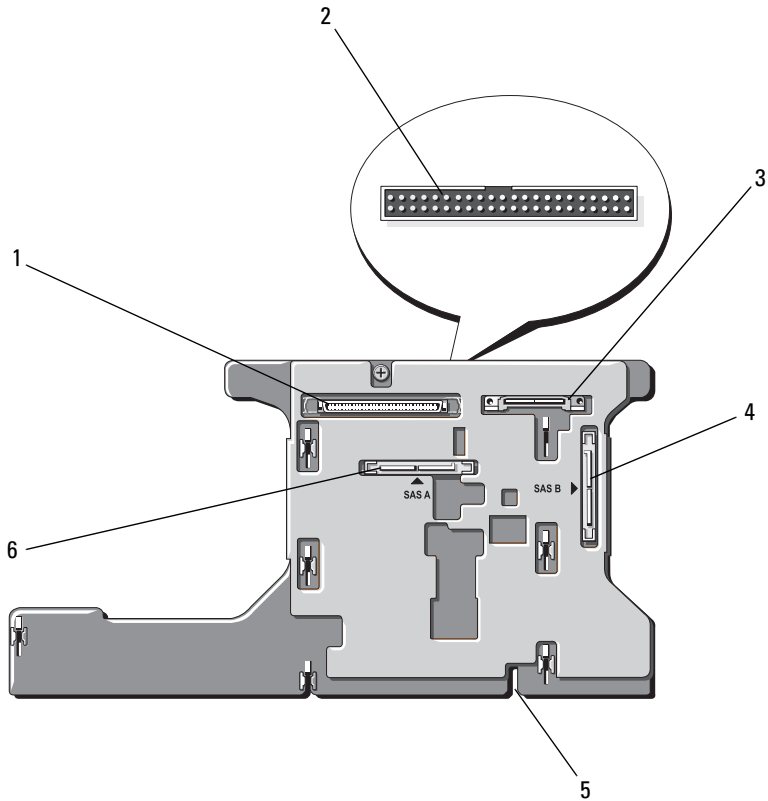
1	data interface	2	control panel (on front of board)
3	power	4	SAS B
5	installation alignment slot	6	power SAS A

Figure 6-4.   SAS Backplane Board Connectors: 2.5-inch Option
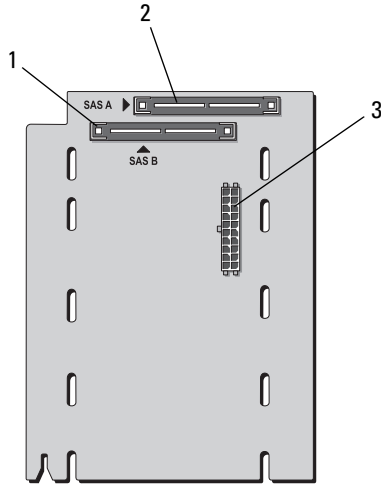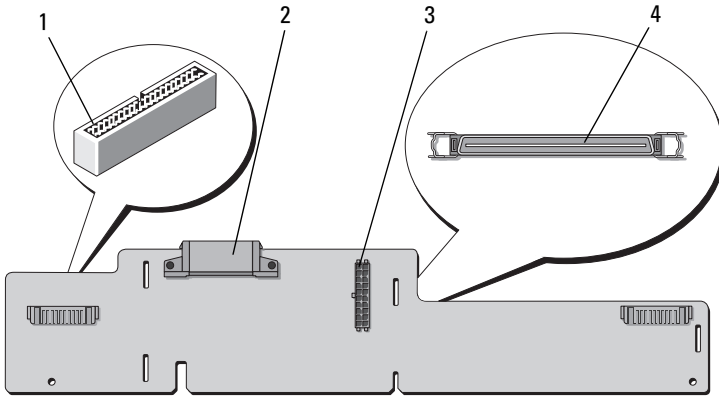

1	SAS B	2	SAS A
3	backplane power		

SAS 2.5-Inch Peripheral Interposer Board

In addition to the backplane, systems with 2.5-inch drives also have a peripheral interposer board.

Figure 6-5.   SAS Peripheral Interposer Board Connectors

1	control panel	2	power
3	power to backplane	4	data interface

7

Getting Help

Contacting Dell

For customers in the United States, call 800-WWW-DELL (800-999-3355).

✍ **NOTE:** If you do not have an active Internet connection, you can find contact information on your purchase invoice, packing slip, bill, or Dell product catalog.

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer service issues:

1 Visit **support.dell.com**.

2 Verify your country or region in the **Choose A Country/Region** drop-down menu at the bottom of the page.

3 Click **Contact Us** on the left side of the page.

4 Select the appropriate service or support link based on your need.

5 Choose the method of contacting Dell that is convenient for you.

Glossary

This section defines or identifies technical terms, abbreviations, and acronyms used in your system documents.

A — Ampere(s).

AC — Alternating current.

ACPI — Advanced Configuration and Power Interface. A standard interface for enabling the operating system to direct configuration and power management.

ambient temperature — The temperature of the area or room where the system is located.

ANSI — American National Standards Institute. The primary organization for developing technology standards in the U.S.

application — Software designed to help you perform a specific task or series of tasks. Applications run from the operating system.

ASCII — American Standard Code for Information Interchange.

asset tag — An individual code assigned to a system, usually by an administrator, for security or tracking purposes.

backup — A copy of a program or data file. As a precaution, back up your system's hard drive on a regular basis. Before making a change to the configuration of your system, back up important start-up files from your operating system.

backup battery — A battery that maintains system configuration, date, and time information in a special section of memory when the system is turned off.

beep code — A diagnostic message in the form of a pattern of beeps from your system's speaker. For example, one beep, followed by a second beep, and then a burst of three beeps is beep code 1-1-3.

BIOS — Basic input/output system. Your system's BIOS contains programs stored on a flash memory chip. The BIOS controls the following:

- Communications between the processor and peripheral devices
- Miscellaneous functions, such as system messages

bit — The smallest unit of information interpreted by your system.

blade — A module that contains a processor, memory, and a hard drive. The modules are mounted into a chassis that includes power supplies and fans.

BMC — Baseboard management controller.

boot routine — A program that clears all memory, initializes devices, and loads the operating system when you start your system. Unless the operating system fails to respond, you can reboot (also called *warm boot*) your system by pressing <Ctrl><Alt><Del>. Otherwise, you must restart the system by pressing the reset button or by turning the system off and then back on.

bootable diskette — A diskette that is used to start your system if the system will not boot from the hard drive.

BTU — British thermal unit.

bus — An information pathway between the components of a system. Your system contains an expansion bus that allows the processor to communicate with controllers for the peripheral devices connected to the system. Your system also contains an address bus and a data bus for communications between the processor and RAM.

C — Celsius.

cache — A fast storage area that keeps a copy of data or instructions for quick data retrieval. When a program makes a request to a disk drive for data that is in the cache, the disk-cache utility can retrieve the data from RAM faster than from the disk drive.

CD — Compact disc. CD drives use optical technology to read data from CDs.

cm — Centimeter(s).

cmos — Complementary metal-oxide semiconductor.

component — As they relate to DMI, components include operating systems, computer systems, expansion cards, and peripherals that are compatible with DMI. Each component is made up of groups and attributes that are defined as relevant to that component.

COM▮ — The device names for the serial ports on your system.

control panel — The part of the system that contains indicators and controls, such as the power button and power indicator.

controller — A chip that controls the transfer of data between the processor and memory or between the processor and a peripheral.

conventional memory — The first 640 KB of RAM. Conventional memory is found in all systems. Unless they are specially designed, MS-DOS® programs are limited to running in conventional memory.

coprocessor — A chip that relieves the system's processor of specific processing tasks. A math coprocessor, for example, handles numeric processing.

CPU — Central processing unit. See *processor*.

DC — Direct current.

DDR — Double-data rate. A technology in memory modules that potentially doubles the output.

device driver — A program that allows the operating system or some other program to interface correctly with a peripheral. Some device drivers—such as network drivers— must be loaded from the **config.sys** file or as memory-resident programs (usually, from the **autoexec.bat** file). Others must load when you start the program for which they were designed.

DHCP — Dynamic Host Configuration Protocol. A method of automatically assigning an IP address to a client system.

diagnostics — A comprehensive set of tests for your system.

DIMM — Dual in-line memory module. See also *memory module*.

DIN — *Deutsche Industrie Norm*.

directory — Directories help keep related files organized on a disk in a hierarchical, "inverted tree" structure. Each disk has a "root" directory. Additional directories that branch off the root directory are called *subdirectories*. Subdirectories may contain additional directories branching off them.

DMA — Direct memory access. A DMA channel allows certain types of data transfer between RAM and a device to bypass the processor.

DMI — Desktop Management Interface. DMI enables the management of your system's software and hardware by collecting information about the system's components, such as the operating system, memory, peripherals, expansion cards, and asset tag.

DNS — Domain Name System. A method of translating Internet domain names, such as **www.dell.com**, into IP addresses, such as 143.166.83.200.

DRAM — Dynamic random-access memory. A system's RAM is usually made up entirely of DRAM chips.

DVD — Digital versatile disc.

ECC — Error checking and correction.

EEPROM — Electronically erasable programmable read-only memory.

EMC — Electromagnetic compatibility.

EMI — Electromagnetic interference.

ERA — Embedded remote access. ERA allows you to perform remote, or "out-of-band," server management on your network server using a remote access controller.

ESD — Electrostatic discharge.

ESM — Embedded server management.

expansion bus — Your system contains an expansion bus that allows the processor to communicate with controllers for peripherals, such as NICs.

expansion card — An add-in card, such as a NIC or SCSI adapter, that plugs into an expansion-card connector on the system board. An expansion card adds some specialized function to the system by providing an interface between the expansion bus and a peripheral.

expansion-card connector — A connector on the system board or riser board for plugging in an expansion card.

F — Fahrenheit.

FAT — File allocation table. The file system structure used by MS-DOS to organize and keep track of file storage. The Microsoft® Windows® operating systems can optionally use a FAT file system structure.

flash memory — A type of EEPROM chip that can be reprogrammed from a utility on diskette while still installed in a system; most EEPROM chips can only be rewritten with special programming equipment.

format — To prepare a hard drive or diskette for storing files. An unconditional format deletes all data stored on the disk.

FSB — Front-side bus. The FSB is the data path and physical interface between the processor and the main memory (RAM).

ft — Feet.

FTP — File transfer protocol.

g — Gram(s).

G — Gravities.

Gb — Gigabit(s); 1024 megabits or 1,073,741,824 bits.

GB — Gigabyte(s); 1024 megabytes or 1,073,741,824 bytes. However, when referring to hard-drive capacity, the term is usually rounded to 1,000,000,000 bytes.

graphics mode — A video mode that can be defined as *x* horizontal by *y* vertical pixels by *z* colors.

group — As it relates to DMI, a group is a data structure that defines common information, or attributes, about a manageable component.

guarding — A type of data redundancy in which a set of physical drives stores data and an additional drive stores parity data. See also *mirroring*, *striping*, and *RAID*.

h — Hexadecimal. A base-16 numbering system, often used in programming to identify addresses in the system's RAM and I/O memory addresses for devices. In text, hexadecimal numbers are often followed by *h*.

headless system — A system or device that functions without having a keyboard, mouse, or monitor attached. Normally, headless systems are managed over a network using an Internet browser.

host adapter — A host adapter implements communication between the system's bus and the controller for a peripheral device. (Hard-drive controller subsystems include integrated host adapter circuitry.) To add a SCSI expansion bus to your system, you must install or connect the appropriate host adapter.

Hz — Hertz.

I/O — Input/output. A keyboard is an input device, and a monitor is an output device. In general, I/O activity can be differentiated from computational activity.

ID — Identification.

IDE — Integrated drive electronics. A standard interface between the system board and storage devices.

integrated mirroring — Provides simultaneous physical mirroring of two drives. Integrated mirroring functionality is provided by the system's hardware. See also *mirroring*.

internal processor cache — An instruction and data cache built into the processor.

IP — Internet Protocol.

IPX — Internet package exchange.

IRQ — Interrupt request. A signal that data is about to be sent to or received by a peripheral device travels by an IRQ line to the processor. Each peripheral connection must be assigned an IRQ number. Two devices can share the same IRQ assignment, but you cannot operate both devices simultaneously.

jumper — Small blocks on a circuit board with two or more pins emerging from them. Plastic plugs containing a wire fit down over the pins. The wire connects the pins and creates a circuit, providing a simple and reversible method of changing the circuitry in a board.

K — Kilo-; 1000.

Kb — Kilobit(s); 1024 bits.

KB — Kilobyte(s); 1024 bytes.

Kbps — Kilobit(s) per second.

KBps — Kilobyte(s) per second.

key combination — A command requiring you to press multiple keys at the same time (for example, <Ctrl><Alt><Del>).

kg — Kilogram(s); 1000 grams.

kHz — Kilohertz.

KMM — Keyboard/monitor/mouse.

KVM — Keyboard/video/mouse. KVM refers to a switch that allows selection of the system from which the video is displayed and for which the keyboard and mouse are used.

LAN — Local area network. A LAN is usually confined to the same building or a few nearby buildings, with all equipment linked by wiring dedicated specifically to the LAN.

lb — Pound(s).

LCD — Liquid crystal display.

LED — Light-emitting diode. An electronic device that lights up when a current is passed through it.

Linux — An open-source operating system, similar to the UNIX® operating system, that runs on a variety of hardware systems. Linux is freely available; however, the full distribution of Linux along with technical support and training are available for a fee from vendors such as Red Hat® Software.

local bus — On a system with local-bus expansion capability, certain peripheral devices (such as the video adapter circuitry) can be designed to run much faster than they would with a traditional expansion bus. See also *bus*.

LVD — Low voltage differential.

m — Meter(s).

mA — Milliampere(s).

MAC address — Media Access Control address. Your system's unique hardware number on a network.

mAh — Milliampere-hour(s).

Mb — Megabit(s); 1,048,576 bits.

MB — Megabyte(s); 1,048,576 bytes. However, when referring to hard-drive capacity, the term is often rounded to mean 1,000,000 bytes.

Mbps — Megabits per second.

MBps — Megabytes per second.

MBR — Master boot record.

memory address — A specific location, usually expressed as a hexadecimal number, in the system's RAM.

memory module — A small circuit board containing DRAM chips that connects to the system board.

memory — An area in your system that stores basic system data. A system can contain several different forms of memory, such as integrated memory (ROM and RAM) and add-in memory modules (DIMMs).

MHz — Megahertz.

mirroring — A type of data redundancy in which a set of physical drives stores data and one or more sets of additional drives stores duplicate copies of the data. Mirroring functionality is provided by software. See also *guarding*, *integrated mirroring*, *striping*, and *RAID*.

mm — Millimeter(s).

ms — Millisecond(s).

MS-DOS® — Microsoft Disk Operating System.

NAS — Network Attached Storage. NAS is one of the concepts used for implementing shared storage on a network. NAS systems have their own operating systems, integrated hardware, and software that are optimized to serve specific storage needs.

NIC — Network interface controller. A device that is installed or integrated in a system to allow connection to a network.

NMI — Nonmaskable interrupt. A device sends an NMI to signal the processor about hardware errors.

ns — Nanosecond(s).

NTFS — The NT File System option in the Windows 2000 operating system.

NVRAM — Nonvolatile random-access memory. Memory that does not lose its contents when you turn off your system. NVRAM is used for maintaining the date, time, and system configuration information.

parity — Redundant information that is associated with a block of data.

partition — You can divide a hard drive into multiple physical sections called *partitions* with the **fdisk** command. Each partition can contain multiple logical drives. You must format each logical drive with the **format** command.

PCI — Peripheral Component Interconnect. A standard for local-bus implementation.

PDU — Power distribution unit. A power source with multiple power outlets that provides electrical power to servers and storage systems in a rack.

peripheral — An internal or external device, such as a diskette drive or keyboard, connected to a system.

PGA — Pin grid array. A type of processor socket that allows you to remove the processor chip.

pixel — A single point on a video display. Pixels are arranged in rows and columns to create an image. A video resolution, such as 640 x 480, is expressed as the number of pixels across by the number of pixels up and down.

POST — Power-on self-test. Before the operating system loads when you turn on your system, the POST tests various system components such as RAM and hard drives.

processor — The primary computational chip inside the system that controls the interpretation and execution of arithmetic and logic functions. Software written for one processor must usually be revised to run on another processor. *CPU* is a synonym for processor.

protected mode — An operating mode that allows operating systems to implement:

• A memory address space of 16 MB to 4 GB

• Multitasking

• Virtual memory, a method for increasing addressable memory by using the hard drive

The Windows 2000 and UNIX 32-bit operating systems run in protected mode. MS-DOS cannot run in protected mode.

PS/2 — Personal System/2.

PXE — Preboot eXecution Environment. A way of booting a system via a LAN (without a hard drive or bootable diskette).

RAC — Remote access controller.

RAID — Redundant array of independent disks. A method of providing data redundancy. Some common implementations of RAID include RAID 0, RAID 1, RAID 5, RAID 10, and RAID 50. See also *guarding*, *mirroring*, and *striping*.

RAM — Random-access memory. The system's primary temporary storage area for program instructions and data. Any information stored in RAM is lost when you turn off your system.

RAS — Remote Access Service. This service allows users running the Windows operating system to remotely access a network from their system using a modem.

readme file — A text file, usually shipped with software or hardware, that contains information supplementing or updating the product's documentation.

read-only file — A read-only file is one that you are prohibited from editing or deleting.

ROM — Read-only memory. Your system contains some programs essential to its operation in ROM code. A ROM chip retains its contents even after you turn off your system. Examples of code in ROM include the program that initiates your system's boot routine and the POST.

ROMB — RAID on motherboard.

rpm — Revolutions per minute.

RTC — Real-time clock.

SAS — Serial-attached SCSI.

SATA — Serial Advanced Technology Attachment. A standard interface between the system board and storage devices.

SCSI — Small computer system interface. An I/O bus interface with faster data transmission rates than standard ports.

SDRAM — Synchronous dynamic random-access memory.

sec — Second(s).

serial port — An I/O port used most often to connect a modem to your system. You can usually identify a serial port on your system by its 9-pin connector.

service tag — A bar code label on the system used to identify it when you call Dell for technical support.

simple disk volume — The volume of free space on a single dynamic, physical disk.

SMART — Self-Monitoring Analysis and Reporting Technology. Allows hard drives to report errors and failures to the system BIOS and then display an error message on the screen.

SMP — Symmetric multiprocessing. Used to describe a system that has two or more processors connected via a high-bandwidth link and managed by an operating system, where each processor has equal access to I/O devices.

SNMP — Simple Network Management Protocol. A standard interface that allows a network manager to remotely monitor and manage workstations.

spanning — Spanning, or concatenating, disk volumes combines unallocated space from multiple disks into one logical volume, allowing more efficient use of all the space and all drive letters on a multiple-disk system.

striping — Disk striping writes data across three or more disks in an array, but only uses a portion of the space on each disk. The amount of space used by a "stripe" is the same on each disk used. A virtual disk may use several stripes on the same set of disks in an array. See also *guarding*, *mirroring*, and *RAID*.

SVGA — Super video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

system board — As the main circuit board, the system board usually contains most of your system's integral components, such as the processor, RAM, controllers for peripherals, and various ROM chips.

system configuration information — Data stored in memory that tells a system what hardware is installed and how the system should be configured for operation.

system diskette — See *bootable diskette*.

system memory — See *RAM*.

System Setup program — A BIOS-based program that allows you to configure your system's hardware and customize the system's operation by setting features such as password protection. Because the System Setup program is stored in NVRAM, any settings remain in effect until you change them again.

system.ini file — A start-up file for the Windows operating system. When you start Windows, it consults the **system.ini** file to determine a variety of options for the Windows operating environment. Among other things, the **system.ini** file records which video, mouse, and keyboard drivers are installed for Windows.

TCP/IP — Transmission Control Protocol/Internet Protocol.

termination — Some devices (such as the last device at each end of a SCSI cable) must be terminated to prevent reflections and spurious signals in the cable. When such devices are connected in a series, you may need to enable or disable the termination on these devices by changing jumper or switch settings on the devices or by changing settings in the configuration software for the devices.

TOE — TCP/IP offload engine.

UNIX — Universal Internet Exchange. UNIX, the precursor to Linux, is an operating system written in the C programming language.

uplink port — A port on a network hub or switch used to connect to other hubs or switches without requiring a crossover cable.

UPS — Uninterruptible power supply. A battery-powered unit that automatically supplies power to your system in the event of an electrical failure.

USB — Universal Serial Bus. A USB connector provides a single connection point for multiple USB-compliant devices, such as mice and keyboards. USB devices can be connected and disconnected while the system is running.

utility — A program used to manage system resources—memory, disk drives, or printers, for example.

UTP — Unshielded twisted pair. A type of wiring used to connect systems in a business or home to a telephone line.

V — Volt(s).

VAC — Volt(s) alternating current.

VDC — Volt(s) direct current.

VGA — Video graphics array. VGA and SVGA are video standards for video adapters with greater resolution and color display capabilities than previous standards.

video adapter — The logical circuitry that provides (in combination with the monitor) your system's video capabilities. A video adapter may be integrated into the system board or may be an expansion card that plugs into an expansion slot.

video driver — A program that allows graphics-mode application programs and operating systems to display at a chosen resolution with the desired number of colors. Video drivers may need to match the video adapter installed in the system.

video memory — Most VGA and SVGA video adapters include memory chips in addition to your system's RAM. The amount of video memory installed primarily influences the number of colors that a program can display (with the appropriate video drivers and monitor capabilities).

video resolution — Video resolution (800 x 600, for example) is expressed as the number of pixels across by the number of pixels up and down. To display a program at a specific graphics resolution, you must install the appropriate video drivers and your monitor must support the resolution.

W — Watt(s).

WH — Watt-hour(s).

win.ini file — A start-up file for the Windows operating system. When you start Windows, it consults the **win.ini** file to determine a variety of options for the Windows operating environment. The **win.ini** file also usually includes sections that contain optional settings for Windows application programs that are installed on the hard drive.

Windows 2000 — An integrated and complete Microsoft Windows operating system that does not require MS-DOS and that provides advanced operating system performance, improved ease of use, enhanced workgroup functionality, and simplified file management and browsing.

Windows Powered — A Windows operating system designed for use on NAS systems. For NAS systems, the Windows Powered operating system is dedicated to file service for network clients.

Windows Server 2003 — A set of Microsoft software technologies that enable software integration through the use of XML Web services. XML Web services are small reusable applications written in XML that allow data to be communicated between otherwise unconnected sources.

XML — Extensible Markup Language. XML is a way to create common information formats and to share both the format and the data on the World Wide Web, intranets, and elsewhere.

ZIF — Zero insertion force.

Index

diagnostics
    advanced testing options, 169
    testing options, 168
    when to use, 168

DIMMs
    See memory modules (DIMMs).

drive blank
    installing, 107
    removing, 107

drive carrier
    hard drive, 109
    optical drive, 104

E

expansion cards
    installing, 78
    removing, 80
    SAS controller, 111
    troubleshooting, 164

expansion slots, 77

F

fan interposer board
    installing, 131
    removing, 130

Fibre Channel storage
        device, 114

front-panel features, 13

G

guidelines
    expansion card installation, 77
    memory installation, 92

H

hard drives (SAS/SATA)
    boot device, 107
    drive carrier, 111
    ID numbers, 105
    indicator codes, 16
    installing, 109
    removing, 108
    troubleshooting, 159

heat sink, 100

hot-plug hard drives, 105

I

indicators
    back-panel, 17
    front-panel, 13
    hard-drive, 16
    NIC, 20
    power, 19

installing, 100
    chassis intrusion switch, 121
    control panel assembly, 119
    expansion card, 78

installing *(continued)*
  fan interposer board, 131
  hard drive blank, 107
  hard drives, 109
  heat sink, 100
  memory modules, 95
  NIC daughter card, 89
  optical drive, 103
  power distribution board, 138
  processor, 99, 101
  RAC card, 83
  RAID battery, 113
  SAS backplane board, 125
  SAS controller, 112
  SD card, 88
  USB memory key, 85

J

jumpers (system board), 171

K

keyboard
  troubleshooting, 146

keystrokes
  RAC features, 12
  startup, 12
  system setup program, 43

M

memory modules (DIMMs)
  configuring, 92
  installing, 95
  removing, 97
  troubleshooting, 156

messages
  alert, 42
  diagnostics, 42
  hard-drive indicator codes, 16
  status LCD, 21
  system, 33
  warning, 42

microprocessor
  See processor.

N

NIC daughter card
  installing, 89
  removing, 91

NICs
  back-panel connectors, 17
  indicators, 20
  troubleshooting, 151

O

optical drive
  drive carrier, 104
  installing, 103
  troubleshooting, 158